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RESEARCH

Effect of health literacy on vaccine hesitancy of parents

Sağlık okuryazarlığının ebeveynlerin aşı tereddüdüne etkisi

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Abstract

Purpose: This study aims to investigate the effect of parents' health literacy on vaccine hesitancy. Additionally, it examines levels of health literacy and vaccine hesitancy among parents in relation to demographic variables. The recent significant increase in vaccine hesitancy and opposition, combined with the limited number of studies focusing on parents, underscores the importance of this research.

Materials and Methods: This quantitative study employed a cross-sectional and descriptive design. Health literacy and vaccine hesitancy scales were used as data collection instruments. The surveys were distributed via online platforms, and data were collected in February 2021. A total of 488 parents residing in Türkiye participated in the study. As the data followed a normal distribution, parametric tests were used for analysis.

Results: Among the participants, 69% were mothers, 30.3% had only one child, and 37.3% were between the ages of 31 and 40. Health literacy was found to be a significant negative predictor of vaccine hesitancy. Similarly, being a father was also a significant negative predictor. Although there was a positive association between educational level and vaccine hesitancy, this relationship was not statistically significant.

Conclusion: Health literacy and paternal status significantly and negatively predicted vaccine hesitancy, while educational level did not show a significant effect. These variables collectively explained 4.5% of the variance in vaccine hesitancy. Although the effect size was modest, higher health literacy and being a father contributed to reduced vaccine hesitancy. In contrast, being a mother and having lower health literacy levels were associated with increased vaccine hesitancy.

Keywords:. Health literacy, parents, vaccination attitude, vaccine hesitancy, vaccine literacy.

Öz

Amaç: Çalışma ebeveynlerin sağlık okuryazarlığının aşı tereddüdü üzerindeki etkisini araştırmayı amaçlamaktadır. Ayrıca çalışmada ebeveynlerin sağlık okuryazarlığı ve aşı tereddüdü düzeyleri demografik değişkenlere göre incelenmiştir. Son dönemlerde aşı tereddüdü ve karşıtlığı konusunda önemli artışların olması ve bu konuda ebeveynler üzerinde yapılan araştırmaların kısıtlı olması bu araştırmanın önemini artırmaktadır.

Gereç ve Yöntem: Nicel çalışma kesitsel ve tanımlayıcıdır. Çalışmada veri toplama aracı olarak sağlık okuryazarlığı ölçeği ve aşı tereddüdü ölçeği kullanılmıştır. Ölçekler çevrimiçi platformlar aracılığıyla dağıtılmıştır. Araştırma verileri Şubat 2021'de toplanmıştır. Çalışmaya Türkiye'de yaşayan toplam 488 ebeveyn dâhil edilmiştir. Normal dağılım sağlandığı için verilerin analizinde parametrik testlerden yararlanılmıştır.

Bulgular: Katılımcıların %69'u annelerden, %30,3'ü tek çocuklu ebeveynlerden, %37,3'ü 31-40 yaş aralığındaki ebeveynlerden oluşmaktadır. Sağlık okuryazarlığı aşı tereddüdünü negatif ve anlamlı bir şekilde açıklamaktadır. Babalık aşı tereddüdünü negatif ve anlamlı bir şekilde açıklamaktadır. Katılımcıların eğitim düzeyi ile aşı tereddüdü arasındaki ilişki pozitif olmasına rağmen, bu ilişki anlamlı değildir.

Sonuç: Sağlık okuryazarlığı ve ebeveynlik bağımsız değişkenleri aşı tereddüdünü negatif ve anlamlı bir şekilde açıklarken, eğitim düzeyinin aşı tereddüdünü anlamlı düzeyde açıklamamaktadır. Bu değişkenler aşı tereddüdünün %4,5'ini açıklamıştır. Etki büyüklüğü çok yüksek olmasa da yüksek sağlık okuryazarlığı ve babalığın aşı tereddütünü azaltmada etkili olduğu görülmüştür. Başka bir deyişle anne olmanın ve ebeveynlerin sağlık okuryazarlığının azalmasının aşı tereddüdünü artırdığı söylenebilir.

Anahtar kelimeler: Sağlık okuryazarlığı, ebeveynler, aşılama tutumu, aşı tereddüdü, aşı okuryazarlığı.

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INTRODUCTION

Widespread vaccination programs play a critical role in preventing infectious diseases that have historically resulted in millions of deaths, as well as reducing the mortality and long-term sequelae associated with these conditions[1]. Vaccination not only provides individual protection but also contributes significantly to herd immunity[2]. Unlike most pharmaceutical interventions, vaccines exert a dual effect benefiting both individuals and the broader community[3,4]. According to a report by the World Health Organization, global immunization initiatives currently prevent between 2 and 3 million deaths each year[5].

With the advent of vaccination, a parallel phenomenon vaccine hesitancy has emerged, prompting individuals to question the safety and necessity of vaccines for various reasons[6]. This issue, often referred to as anti-vaccination or vaccine hesitancy, was identified by the World Health Organization in 2019 as one of the top ten global health threats[7]. Vaccine hesitancy is defined as the delay in acceptance or the outright refusal of vaccines despite the availability of vaccination services[8]. Certain segments of the population have exhibited skepticism toward vaccines, sometimes attributing unexplained diseases to immunization. Although vaccine hesitancy has existed historically, it has escalated rapidly and alarmingly in recent years, driven largely by mass communication channels, particularly social media[9]. This growing resistance has contributed to a decline in vaccination coverage and the resurgence of vaccine-preventable diseases[2]. Of particular concern is parental vaccine hesitancy, which plays a pivotal role in the reemergence of contagious diseases among children[10].

The primary narratives fueling vaccine hesitancy include concerns over potentially harmful chemical components in vaccines, mistrust of pharmaceutical companies' profit motives, and the belief that natural immunity provides sufficient protection[2]. Although these beliefs lack scientific foundation, they have gained considerable traction and now pose a significant threat to public health, underscoring the need for further investigation[10].

According to the National Vaccine Workshop Report, low health literacy is a key factor contributing to vaccine hesitancy[11]. Health literacy refers to an individual's ability to obtain, process, and understand essential health information in order to make informed healthcare decisions[12]. It is widely recognized as a critical determinant of health outcomes[13]. More specifically, health literacy encompasses the capacity to access, comprehend, and apply health-related information to protect and maintain one's health[14]. Broadly speaking, it is closely linked to general literacy and reflects an individual's willingness and ability to engage with healthcare services, accurately interpret medical information, and make decisions that improve overall quality of life[8].

Empirical studies have demonstrated that individuals with lower levels of health literacy are less likely to adhere to both preventive and therapeutic medical recommendations[13,15]. Furthermore, inadequate health literacy may negatively impact personal, social, and cultural well-being[16]. As noted by Patel et al., health literacy enhances immunization knowledge and positively influences health-related attitudes and behaviors[17]. Similarly, a study conducted by Çam et al. identified a positive correlation between health literacy and immunization knowledge among adults aged 18 and older[18]. The overall effectiveness of vaccination programs is strongly influenced by individuals' levels of health literacy[15,18,19].

A review of historical developments clearly demonstrates that vaccination, immunization, and vaccine development have had a substantial impact on public health. Despite this well-documented significance, vaccine hesitancy and refusal, particularly concerning childhood vaccinations, have escalated in recent years. In Türkiye, the number of families refusing vaccination rose sharply from 183 in 2010 to 23,000 in 2017[2]. This alarming increase poses a serious threat to public health. Raising public awareness on this issue is therefore critical. Enhancing health literacy, a cornerstone of preventive and health-promoting strategies, may help mitigate vaccine hesitancy. Individuals who develop and apply health literacy skills are more likely to make informed decisions regarding their health.

In this context, the present study aimed to examine the effect of health literacy on vaccine hesitancy among parents. In addition, it sought to compare parents' health literacy and vaccine hesitancy scores based on various sociodemographic characteristics. Given the recent rise in vaccine hesitancy and refusal, particularly in relation to childhood immunizations,

parents were identified as the primary population of interest.

Although previous studies have explored the relationship between vaccine hesitancy and health literacy, this study specifically investigated the influence of health literacy on vaccine hesitancy from a parental perspective, with particular emphasis on the roles and educational levels of parents. In this regard, the study contributes to a deeper understanding of the increasing trend of vaccine hesitancy in the context of childhood immunization. The research hypothesis is as follows:

H_1: Health literacy significantly predicts vaccine hesitancy in parents.

MATERIALS AND METHODS

This study employed a quantitative, cross-sectional design utilizing a descriptive survey methodology.

Sample

The target population consisted of parents residing in Türkiye who had at least one child. However, the total number of individuals with children in Türkiye as of 2021 was not reported. To determine the appropriate sample size for analyzing the effect of health literacy on vaccine hesitancy, a power analysis was conducted. Based on this analysis, a sample size of 205 participants was found to be sufficient for a regression model involving three independent variables, assuming a medium effect size ($r = 0.15$), a 1% margin of error, and a 99% confidence level. Given the nationwide scope of the study, a target of at least 450 participants was established.

Data were collected through an online questionnaire distributed via social media platforms using a convenience sampling method. A total of 572 responses were received. However, 55 responses were excluded because the individuals were not parents, and 29 were excluded due to incomplete or invalid responses (e.g., completing the survey without reading it). Ultimately, the final sample included 488 parents who voluntarily participated and fully completed the questionnaire.

The inclusion criteria for participants were as follows: (1) residing in Türkiye, (2) being over 18 years of age, (3) having at least one child, (4) being able to communicate effectively, and (5) being literate and capable of using social media platforms, as data collection was conducted online. The exclusion criteria were: (1) refusal to complete the questionnaire, (2) incomplete survey responses, (3) being under 18 years of age, and (4) not having any children.

Sample size estimation was performed using G*Power version 3.1.9.4, and all data analyses were conducted using IBM SPSS Statistics (version 27). The initial dataset consisted of 572 responses, which were reviewed and cleaned prior to analysis. A total of 84 cases were excluded: 55 participants were not parents, and 29 failed the attention-check item. Consequently, the final sample included 488 valid responses.

Procedure

Data were collected through an online survey created using Google Forms and distributed via social media platforms (e.g., Facebook, Instagram, WhatsApp). The survey comprised 45 items, categorized as follows:

- 7 items assessing socio-demographic characteristics,
- 12 items measuring vaccine hesitancy,
- 25 items evaluating health literacy, and
- 1 attention-check item to ensure participants were reading the survey carefully.

The attention-check item stated: *"This question has been added to ensure you read the survey carefully. If you are reading this question, please select 'Yes'."* Participants who selected 'No' in response to this item were excluded from the study.

To enhance usability and maximize response rates, the survey was designed to be completed on a single page. Prior to distribution, the survey was pilot-tested with 10 individuals to identify and resolve any issues related to content clarity or usability. Following necessary revisions, the final version was distributed along with a brief introduction outlining the purpose of the study and the criteria for participation.

Participation in the study was entirely voluntary. At the beginning of the survey, participants were provided with an informed consent form stating that they could withdraw from the study at any time without providing a reason. All survey items were mandatory in order to prevent missing data. Respondents were permitted to review and revise their answers before final submission.

Data were retained only from individuals who provided informed consent and completed the entire survey. No responses were included from participants who began but did not complete the questionnaire. The data collection period spanned three weeks in February 2021. To prevent duplicate entries, email verification was implemented, ensuring that only one submission was accepted per participant.

Measures

Data were collected using a structured survey form composed of three sections. The first section gathered socio-demographic information; the second included the Health Literacy Scale; and the third contained the Vaccine Hesitancy Scale.

Socio-demographic information form

The socio-demographic information form comprised seven items related to parenting status, age, number of children, income level, educational attainment, place of residence, and geographic region.

Health Literacy Scale

Participants' health literacy levels were assessed using the Health Literacy Scale, initially developed by Sørensen et al. (47 items) and later shortened to 25 items by Toçi et al. for improved applicability[20,21]. The Turkish version of the scale was validated and tested for reliability by Aras and Bayık Temel[22]. The dimensions and number of questions in the original and adapted versions of the scale have similar cultural characteristics. The scale comprises 25 items across four sub-dimensions, and its cultural structure was preserved during adaptation. Responses are scored using a five-point Likert scale ranging from 1 (I am unable to do it) to 5 (I have no difficulty at all). The scale yields a minimum score of 1 and a maximum of 5. The scale's internal consistency in the current study was high, with a Cronbach's alpha coefficient of 0.925.

Vaccine Hesitancy Scale

Vaccine hesitancy was measured using the Vaccine Hesitancy Scale, which was developed by Kılınçarslan et al. within the Turkish cultural context[23]. The scale consists of 12 items grouped into three sub-dimensions. Items are rated on a five-point Likert scale from 1 (Strongly Disagree) to 5 (Strongly Agree). Higher scores indicate greater levels of vaccine hesitancy. The possible total score ranges from 1 to 5. The scale demonstrated excellent reliability in the present study, with a Cronbach's alpha of 0.922.

Statistical analysis

The normality of the data was assessed using skewness and kurtosis coefficients. As all values fell within the acceptable range of -1 to +1, the data were considered normally distributed (see Table 2). Accordingly, in addition to descriptive statistics, inferential analyses—including independent samples t-tests, one-way analysis of variance (ANOVA), and multiple linear regression—were performed.

Descriptive statistics included frequencies, means, standard deviations, percentages, and minimum and maximum values. In the t-test and ANOVA analyses, demographic variables served as independent variables, while health literacy and vaccine hesitancy—as well as their sub-dimensions—were treated as dependent variables. Furthermore, a multiple linear regression analysis was conducted to examine the predictive value of health literacy, education level, and parenting status on vaccine hesitancy. Education level was included in the model due to its well-established association with health literacy, while parenting status (i.e., mother vs. father) was considered for its potential influence on both health literacy and vaccine hesitancy (see Tables 3 and 4). Parenting status was coded as a dummy variable, with "mother" serving as the reference category. All statistical tests were conducted with a 95% confidence interval, and p-values less than 0.05 were considered statistically significant.

RESULTS

This section presents the findings of the study, including descriptive statistics, independent samples t-tests, one-way analysis of variance (ANOVA), and multiple linear regression analyses.

As presented in Table 1, 69.9% of the study participants were mothers, 66.9% were under the age of 40, and approximately 42% earned an income at or below the minimum wage. Among the parents, 30.3% had one child, 35.9% had two children, and 33.8% had three or more children. Furthermore, 52.9% of the participants had completed postgraduate education. Regarding geographic distribution, 50.2% of the participants lived in a metropolitan area, while 40% resided in the Marmara region.

Table 1. Socio-demographic characteristics of the parents.

Variables		**n**	**%**
Parenting	Father	147	30.1
	Mother	341	69.9
Age	20-30	130	26.6
	31-40	182	37.3
	41-50	121	24.8
	51+	55	11.3
Number of Children	1	148	30.3
	2	175	35.9
	3+	165	33.8
Income Status (TL)	Less than minimum wage	204	41.8
	More than minimum wage	284	58.2
Educational Level	Primary School	129	26.4
	High School	101	20.7
	University	258	52.9
Place of Residence	Village/Town	33	6.8
	District	123	25.2
	City	87	17.8
	Metropolis	245	50.2
Region	Mediterranean	54	11.1
	Black Sea	14	2.9
	Aegean	37	7.6
	Marmara	195	40,0
	Central Anatolia	95	19.5
	Eastern Anatolia	37	7.6
	Southeastern Anatolia	56	11.5
Total		**488**	**100.00**

TL: Turkish Lira

Table 2 presents the psychometric characteristics of the vaccine hesitancy and health literacy subscales. The Cronbach's alpha coefficients for the vaccine hesitancy scale range from 0.631 to 0.953, while those for the health literacy scale range from 0.679 to 0.866. Given the skewness and kurtosis values, which indicate reliability in terms of internal consistency, it is evident that the data follow a normal distribution.

Table 2. Psychometric characteristics of the vaccine hesitancy and health literacy subscales.

		Number of Items	**Min**	**Max**	**Cronbach's Alpha**	**Mean**	**SD**	**Normality Test**	
								Skewness	Kurtosis
Benefits and Protective Value of Vaccines	Vaccine Hesitancy	4	1	5	0.953	2.39	1.40	0.693	-0.914
Vaccine Repugnance		5	1	5	0.860	3.31	1.15	-0.111	-0.919
Solution for Non-vaccination		3	1	5	0.631	2.69	1.11	0.402	-0.508
Access to Information	Health Literacy	5	1	5	0.866	4.39	0.73	-0.323	0.477
Comprehension of Information		7	1	5	0.827	4.25	0.71	-0.126	0.300
Evaluation of Information		8	1	5	0.853	4.30	0.66	-0.846	-0.900
Application of Information		5	1	5	0.679	4.22	0.64	-0.699	0.058

Min: Minimum, Max: Maximum, SD: Standard Deviation

Table 3 compares the vaccine hesitancy scale and its subscales according to the participants' socio-demographic characteristics. The analysis revealed a significant difference in the subscale scores for the benefits and protective value of vaccines, vaccine repugnance, and solutions for non-vaccination based on the participants' parenting status ($p<0.05$). In all subscales, mothers had higher mean scores than fathers. Although mothers acknowledged the benefits and protective value of vaccines, they exhibited vaccine avoidance and sought alternative solutions. Furthermore, mothers showed significantly higher levels of vaccine hesitancy than fathers ($p<0.05$). A significant difference was also observed in the subscale means for the benefits and protective value of vaccines and vaccine repugnance based on the participants' age ($p<0.05$). Specifically, participants aged 51 years and older were less likely to avoid vaccines, despite not believing in their benefits and protective value, compared to younger participants. Additionally, the mean vaccine hesitancy scores were significantly lower in participants aged 51 years and older ($p<0.05$). Finally, no significant differences were found in the vaccine hesitancy scale and subscale means based on the participants' educational background, monthly income, or number of children ($p>0.05$).

Table 3. Evaluation of socio-demographic characteristics of the parents and the vaccine hesitancy subscale scores.

Independent Variable	n	Benefits and Protective Value of Vaccines		Vaccine Repugnance		Solution for Non-vaccination		Vaccine Hesitancy	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD
Parenting									
Father	147	1.98	1.13	2.99	1.01	2.46	0.87	2.52	0.83
Mother	341	2.57	1.47	3.45	1.14	2.79	1.19	2.99	1.12
t		-4.821		-4.421		-3.357		-4.562	
p		<0.001***		<0.001***		0.001**		<0.001***	
Monthly Income									
Less than minimum wage	204	2.46	1.34	3.42	0.98	2.74	1.05	2.93	0.92
More than minimum wage	284	2.35	1.45	3.24	1.21	2.66	1.67	2.80	1.16
t		0.841		1.803		0.754		1.382	
p		0.401		0.072		0.451		0.168	
Age									
20-30[a]	130	2.70	1.55	3.46	1.18	2.83	1.20	3.05	1.16
31-40[b]	182	2.36	1.39	3.37	1.11	2.71	1.17	2.87	1.09
41-50[c]	121	2.40	1.37	3.30	1.06	2.66	1.01	2.84	0.96
51+[d]	55	1.74	0.77	2.80	1.04	2.38	0.88	2.34	0.75
F		6.295		4.718		2.089		5.804	
p		<0.001***		0.003**		0.101		<0.001***	
Difference (Scheffe)		d < a, b, c		d< a, b		-		d < a, b, c	
Educational Background									
Primary School[a]	129	2.30	1.23	3.35	0.99	2.81	0.98	2.87	0.81
High School[b]	101	2.25	1.30	3.26	1.04	2.55	1.10	2.75	0.95
University[c]	258	2.49	1.51	3.31	1.21	2.69	1.18	2.88	1.21
F		1.433		0.179		1.632		0.611	
p		0.240		0.836		0.197		0.543	
Difference		-		-		-		-	
Number of Children									
1[a]	148	2.50	1.48	3.40	1.18	2.70	1.18	2.93	1.17
2[b]	175	2.32	1.42	3.29	1.14	2.62	1.10	2.80	1.08
3+[c]	165	2.38	1.31	3.25	1.05	2.76	1.06	2.83	0.94
F		0.690		0.764		0.641		0.585	
p		0.502		0.467		0.527		0.557	
Difference		-		-		-		-	

n=488; SD: Standard Deviation, **p<0.01, ***p<0.001

Table 4 compares the health literacy scale and its subscales according to the participants' socio-demographic characteristics. A significant difference was found in the subscale means for access to information, comprehension of information, and evaluation of information based on parenting status ($p<0.05$), with mothers having higher mean scores than fathers. However, no significant difference was observed in the 'applying the information' subscale ($p>0.05$). Additionally, a significant difference in the overall health literacy mean was found in favor of mothers ($p<0.05$). Regarding monthly income, a significant difference was observed in the subscale scores for access to information, comprehension of information, evaluation of information, and overall health literacy ($p<0.05$). Specifically, participants with a monthly income below the minimum wage scored lower than those with an income above the minimum wage.

Table 4. Evaluation of socio-demographic characteristics of the parents and the health literacy subscale scores.

Independent Variable	n	Access to Information		Comprehension of Information		Evaluation of Information		Application of Information		Health Literacy	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Parenting											
Father	147	4.21	0.74	4.07	0.63	4.07	0.67	4.17	0.62	4.12	0.54
Mother	341	4.47	0.72	4.32	0.73	4.40	0.63	4.24	0.65	4.36	0.57
t		-3.588		-3.534		-5.272		-1.135		-4.324	
p		<0.001***		<0.001***		<0.001***		0.257		<0.001***	
Monthly Income											
Less than minimum wage	204	4.16	0.86	4.08	0.80	4.20	0.70	4.25	0.69	4.17	0.64
More than minimum wage	284	4.56	0.58	4.37	0.62	4.38	0.62	4.20	0.61	4.38	0.51
t		-5.883		-4.276		-2.895		0.899		-3.813	
p		<0.001***		<0.001***		0.004**		0.369		<0.001***	
Age											
20-30[a]	130	4.49	0.69	4.34	0.75	4.40	0.67	4.22	0.67	4.37	0.58
31-40[b]	182	4.33	0.75	4.27	0.68	4.28	0.66	4.15	0.66	4.26	0.57
41-50[c]	121	4.46	0.75	4.25	0.72	4.36	0.68	4.29	0.63	4.30	0.60
51+[d]	55	4.22	0.68	3.96	0.71	4.22	0.56	4.27	0.51	4.16	0.48
F		2.668		3.736		1.496		1.201		1.923	
p		0.047*		0.011*		0.215		0.309		0.125	
Difference (Scheffe)		d < a,b,c		d < a,b,c		-		-		-	
Educational Background											
Primary School[a]	129	4.08	0.83	4.00	0.81	4.11	0.69	4.22	0.68	4.09	0.64
High School[b]	101	4.26	0.81	4.21	0.73	4.32	0.66	4.29	0.72	4.27	0.62
University[c]	258	4.60	0.57	4.38	0.61	4.39	0.62	4.19	0.59	4.39	0.49
F		25.679		13.151		7.570		0.875		11.637	
p		<0.001***		<0.001***		<0.001***		0.439		<0.001***	
Difference (Scheffe)		a < b < c		a < b < c		a < b < c		-		a < b < c	
Number of Children											
1[a]	148	4.50	0.62	4.33	0.74	4.33	0.69	4.17	0.66	4.33	0.57
2[b]	175	4.44	0.75	4.28	0.65	4.36	0.64	4.23	0.66	4.33	0.57
3+[c]	165	4.23	0.79	4.14	0.72	4.21	0.64	4.24	0.61	4.20	0.58
F		5.998		3.213		2.534		0.470		2.811	
p		0.003**		0.041*		0.080		0.625		0.061	
Difference (Scheffe)		b, c < a		c < a		-		-		-	

n=488; SD: Standard Deviation; *p<0.05, **p<0.01, ***p<0.001

However, no significant difference was found in the 'applying the information' subscale based on monthly income (p>0.05). Significant differences were also observed in the means for access to information and comprehension of information according to the participants' age (p<0.05). Participants aged 51 years and older had lower mean scores than those in younger age groups. No significant difference was found in the overall health literacy mean or in the subscale means for evaluation of information and applying the information based on age (p>0.05). A significant difference was noted in the means for access to information, comprehension of information, and evaluation of information according to the participants' educational background (p<0.05). Similarly, a significant difference was found in the overall health literacy means based on educational background (p<0.05). As participants' educational level increased, so did their health literacy scale and subscale scores. However, no significant difference was observed in the 'applying the information' subscale based on educational background (p>0.05).

Finally, a significant difference was found in the means for access to information and comprehension of information according to the number of children the participants had (p<0.05). Parents with only one child had higher mean scores than those with two, three, or more children. No significant difference was observed in the overall health literacy mean or in the subscale means for evaluation of information and applying the information based on the number of children (p>0.05).

Table 5 presents the results of the multiple linear regression analysis conducted to predict vaccine hesitancy using the independent variables of health literacy, education level, and parenting. The analysis revealed a significant regression model (F=8.68, p<0.001), with the independent variables in the model explaining 4.5% of the variance in vaccine hesitancy. Among the independent variables, health literacy was found to negatively and significantly predict vaccine hesitancy (β=-0.097, t=-2.071, p=0.039). Fatherhood also had a negative and significant effect on vaccine hesitancy (β=-0.233, t=-5.025, p<0.001). In contrast, although the relationship between participants' education level and vaccine hesitancy was positive, it was not statistically significant (β=0.067, t=1.425, p>0.05). Based on these findings, the research hypothesis is accepted.

Table 5. Multiple linear regression analysis results.

Independent Variables	B	S E	β	95% CI for B		*t*	*p*	VIF	R	$R^2_{Adj.}$	*F*	*p*
				Lower	Upper							
(Constant)	3.599	0.369		2.874	4.324	9.759	<0.001***		0.226	0.045	8.680	<0.001***
HL	-0.179	0.087	-0.097	-0.349	-0.009	-2.071	0.039*	1.120				
EL	0.041	0.029	0.067	-0.016	0.097	1.425	0.155	1.112				
Parenting[1]	-0.541	0.108	-0.233	-0.753	-0.330	-5.025	<0.001***	1.095				

n=488; Dependent Variable = Vaccine Hesitancy, HL: Health Literacy, EL: Educational Level , [1]Parenting (Reference: "Mother") *p<0.05, ***p<0.001

DISCUSSION

As observed in most pandemics throughout history, social immunization through vaccination plays a critical role in eliminating epidemics at the societal level. However, misinformation on social media and environmental influences have contributed to growing vaccine hesitancy or opposition among specific population segments. Notably, infant vaccination rates declined by 2–3% after 2016, accompanied by a rise in vaccine-preventable diseases such as measles[11]. This trend has been linked to increased vaccine hesitancy among parents. Improving health literacy at the societal level can potentially mitigate this issue. In this context, the present study was conducted with 488 parents to investigate whether vaccine hesitancy and health literacy levels differ based on various socio-demographic factors, and whether health literacy significantly predicts vaccine hesitancy.

The findings showed no significant differences in vaccine hesitancy according to parents' educational background, monthly income, or number of children. This is consistent with previous research reporting no significant relationship between parental education levels and adherence to childhood vaccination schedules [24]. However, parenting status was associated with differences in vaccine hesitancy, with mothers exhibiting higher hesitancy levels than fathers. This finding aligns with studies by Latkin et al. and Allington et al., which reported that women

are more likely to express uncertainty regarding vaccines or display higher levels of vaccine hesitancy[25,26]. In addition, participants aged 51 and older demonstrated lower vaccine hesitancy levels than younger participants[26]. This result is supported by findings from Aharony and Goldman, who noted that vaccine hesitancy and refusal were more prevalent among younger parents[27].

Regarding health literacy, the study found no significant difference in overall health literacy scores based on participants' age or number of children. However, mothers had significantly higher health literacy scores than fathers, a result echoed by various studies reporting higher health literacy among female participants[28,29,30,31]. Educational attainment was also significantly associated with health literacy, with postgraduate parents scoring higher than high school graduates, who in turn scored higher than primary school graduates. This trend reflects findings by Biasio, who observed that parental interest in vaccination increases proportionally with educational level and expectations for information provision from healthcare professionals[32]. Moreover, participants with monthly incomes above the minimum wage had significantly higher health literacy levels than those earning below the threshold. This finding is supported by research conducted by Güven, which demonstrated a positive relationship between income and health literacy in a Turkish context[29].

The multiple linear regression analysis revealed that health literacy had a significant negative effect on vaccine hesitancy, indicating that higher health literacy is associated with lower levels of hesitancy. Fatherhood also had a significant negative association with vaccine hesitancy. However, educational level was not a significant predictor of hesitancy. Aharony and Goldman previously noted that vaccine-hesitant parents tend to have less knowledge about vaccines[27]. Similarly, Akbulut emphasized that individuals with lower health literacy are less likely to engage in preventive health behaviors, including routine check-ups and vaccinations[33]. Biasio also noted that lower health literacy correlates with poorer health choices, riskier behavior, and increased healthcare utilization[34]. According to the SAGE report, while low health literacy in India was not associated with vaccine hesitancy, higher health literacy in Nigeria and Kyrgyzstan correlated with reduced vaccine hesitancy[35]. Studies examining flu vaccination have also found a positive correlation between health literacy and vaccine uptake[15,36]. Furthermore, research on COVID-19 vaccine refusal has shown that lower health literacy is associated with higher refusal rates[37]. In contrast, Casigliani et al. found no correlation between health literacy and vaccine trust, possibly due to differences in sample characteristics and measurement tools[38]. Notably, most existing studies assess general health literacy rather than vaccine-specific literacy, highlighting a gap in the literature. Therefore, developing validated instruments to measure vaccine literacy in the Turkish context is recommended for future research.

In conclusion, this study identified health literacy and parenting status (being a father) as significant negative predictors of vaccine hesitancy. These findings suggest that parents with lower health literacy and female parents are more likely to experience vaccine hesitancy. While the effect sizes were modest, the results indicate that improving health literacy and targeting interventions toward mothers may help reduce vaccine hesitancy. Awareness campaigns and educational initiatives to increase health literacy among parents may be beneficial.

The study has several limitations. Data collection was limited to 488 voluntary participants recruited via online platforms, which restricts the sample to literate individuals with internet access. Additionally, although the participants were parents, no data were collected regarding the age of their children, limiting the ability to assess how child age may relate to parental vaccine hesitancy. The study was also conducted during the COVID-19 pandemic, which may have influenced responses and generalizability.

Future research should consider developing and applying specific tools to assess vaccine literacy, rather than relying solely on general health literacy measures. Additionally, collecting data on children's ages and incorporating this into the analysis could provide more nuanced insights. Qualitative methods such as in-depth interviews with vaccine-hesitant individuals are recommended to further investigate the drivers of vaccine hesitancy. Mixed-method approaches may offer a more comprehensive understanding of the issue.

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