

Relationship between Health Literacy and Medication Adherence in Patients with Hypertension in Gonabad, Iran

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Background and Objective: Hypertension is a major modifiable risk factor for cardiovascular diseases. Despite effective therapies, poor medication adherence remains a significant barrier to blood pressure control. This study aimed to determine the levels of health literacy and medication adherence and examine their relationship among hypertensive patients in Gonabad, Iran.

Materials and Methods: In this analytical cross-sectional study, 350 hypertensive patients attending urban and rural health centers in Gonabad in 2023 were enrolled using stratified proportional sampling. Data were collected using a demographic questionnaire, the 8-item Morisky Medication Adherence Scale (MMAS-8), and the Health Literacy for Iranian Adults (HELIA) questionnaire. Data analysis was performed using SPSS version 24, utilizing Spearman correlation, Mann-Whitney U, and Kruskal-Wallis tests. The significance level was set at $p < 0.05$. Ethical approval was obtained (IR.GMU.REC.1401.195). Response rate: 96%. Cronbach's alpha across the five HELIA domain scores in the present sample was 0.88.

Results: The mean age of participants was 56.71 ± 7.20 years, and 51.7% were female. Regarding medication adherence, 38.0% had poor adherence, 50.0% had moderate adherence, and 12.0% demonstrated full adherence. For health literacy, 31.4% of participants had inadequate health literacy, 24.0% had marginally adequate, 30.9% had adequate, and 13.7% had excellent health literacy. Spearman correlation revealed a statistically significant positive relationship between health literacy and medication adherence ($r = 0.11$, $p = 0.033$).

Conclusion: The majority of hypertensive patients in Gonabad exhibited suboptimal medication adherence and insufficient health literacy. The significant positive correlation indicates that higher health literacy is associated with better adherence. These findings highlight the need for targeted health literacy interventions to improve medication-taking behavior and blood pressure management in this population. Limitations include the cross-sectional design, self-reported measures, and convenience sampling within strata.

Keywords: Hypertension, Health Literacy, Medication Adherence, MMAS-8, HELIA

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Introduction

Hypertension (high blood pressure) is one of the most prevalent and significant modifiable risk factors for cardiovascular and non-communicable diseases globally. Recent estimates suggest that approximately 1.4 billion adults aged 30–79 years worldwide live with hypertension, representing about 33% of this age group. Despite the availability of effective treatments, only a small fraction (approximately 23%) achieve controlled blood pressure levels (1). In Iran, the 2021 STEPS survey estimated the prevalence of hypertension at 32.0% among adults, with similar rates observed in both women (32.9%) and men (30.9%) (2). Effective hypertension control depends on sustained engagement with both lifestyle modification and pharmacological treatment. Medication adherence refers to the extent to which a patient's medication-taking behavior corresponds with recommendations agreed upon with a healthcare provider (3). Because antihypertensive treatment is generally long term, missed doses, incorrect dosing, and premature discontinuation can undermine treatment effectiveness even when appropriate medicines are available. Poor adherence has been associated with disease progression, cardiovascular and cerebrovascular events, kidney disease, lower quality of life, avoidable healthcare expenditure, and hospitalization (4, 5).

Health literacy provides an important framework for understanding this problem. It encompasses the ability to access, obtain, process, understand, evaluate, and apply health information to make appropriate decisions (6). In hypertension, these competencies may determine whether patients recognize the chronic and often silent nature of the disease, understand the purpose and timing of each medicine, interpret written and oral instructions, judge the credibility of health information, communicate effectively with health professionals, and make treatment decisions consistent with disease control. Health literacy is therefore broader than general reading ability or years of formal education: it includes functional, communicative, critical, and decision-making capacities that support self-management. The Institute of Medicine framework further positions health literacy within the interaction between individuals and the health, educational, cultural, and social systems in which care is delivered (7).

Available evidence supports a meaningful, although not uniformly consistent, relationship between health literacy and adherence. In a study of 919 adults with uncontrolled hypertension, participants with likely limited health literacy were less likely than those with adequate literacy to reconcile chronic medications, identify medication indications, and demonstrate correct instructions and dosing (8). A cross-sectional study of 1,355 Hispanic adults found that 84.9% had inadequate health literacy and 88.4% had low adherence; after adjustment for demographic and psychological covariates, adequate literacy was associated with higher adherence (9). Similarly, a study in Northern Cyprus reported low levels of both constructs and a moderate positive correlation between health-literacy and medication-

adherence scores (10). Iranian evidence is also relevant. In Heris County, East Azerbaijan, 68% of hypertensive participants had poor health literacy and only 7% maintained high adherence; health literacy was significantly associated with adherence in both men and women, particularly through communication and decision-making skills (11). Among older adults with hypertension in Sarab, Iran, demographic characteristics, illness perception, and health-literacy dimensions together explained 21.5% of the variance in adherence, indicating that literacy operates alongside beliefs, resources, and treatment context rather than as an isolated determinant (12).

Nevertheless, the studies cited above do not justify assuming a simple or universal relationship: although most report a positive association between health literacy and adherence, its strength and even its direction vary across populations, instruments, and outcomes, as the following findings illustrate. A systematic review of older adults found that most included studies reported a positive association between self-reported health literacy and medication adherence, but it also identified substantial heterogeneity in definitions, measurement instruments, cutoffs, and study quality (13). The Chicago study likewise found that low literacy was associated with poorer medication knowledge and dosing comprehension, while short-term self-reported adherence was paradoxically higher in the low-literacy group, suggesting that different dimensions of medication self-management may not move together (14). These inconsistencies may reflect differences in age, education, socioeconomic conditions, medication complexity, social support, disease duration, cultural expectations, and the tools used to measure literacy and adherence. Cross-sectional evidence can identify associations but cannot establish that limited health literacy causes non-adherence.

The specific problem in Gonabad is therefore twofold. The practical problem is that hypertension requires lifelong treatment, yet the extent to which inadequate health literacy coexists with poor adherence among patients attending Gonabad's urban and rural health centers is unknown. The evidentiary problem is that no locally generated evidence on this association is available, and findings from other regions that differ in instruments and populations cannot simply be transferred. A focused investigation among hypertensive patients in Gonabad City is consequently necessary to characterize health-literacy and medication-adherence levels and to clarify their association.

Materials and Methods

Study Design

This analytical cross-sectional study was conducted in Gonabad City, Razavi Khorasan Province, Iran, in 2023. Data were collected over a period of 10 months, from february to november.

Study Setting and Population

The study was conducted across urban and rural health centers of Gonabad City. The target population comprised adults aged 18 to 65 years who had been previously diagnosed with



hypertension (defined as systolic blood pressure ≥ 140 mmHg and/or diastolic blood pressure ≥ 90 mmHg on repeated measurements) and were receiving antihypertensive pharmacotherapy at the time of enrollment.

Eligibility Criteria

Inclusion criteria were: (1) willingness to provide informed consent to participate in the study; (2) confirmed diagnosis of hypertension with an active pharmacological treatment regimen; (3) residence in Gonabad City; and (4) age between 18 and 65 years. Exclusion criteria were: (1) refusal to cooperate with questionnaire completion; and (2) incomplete questionnaire responses (more than 20% of items unanswered).

Sample Size and Sampling Strategy

Sample size was determined based on a comparable prior study (15), using a 95% confidence interval, 80% study power, and a margin of error of 7.4% ($d=0.3p$), applying the formula:

$$n = \frac{\left(Z_{1-\frac{\alpha}{2}} + Z_{1-\beta} \right)^2 P(1-P)}{d^2} = 350$$

The required sample size was therefore 350 participants. A stratified proportional sampling strategy was employed, whereby each health center constituted a stratum and participants were recruited proportionally according to the hypertensive patient load of each center, selecting eligible attendees via convenience sampling.

Data Collection Instruments

Three validated instruments were used:

(a) Demographic Questionnaire: Collected information on age, sex, education, income, residence, occupation, insurance, disease duration, and health information sources.

(b) Morisky Medication Adherence Scale-8 (MMAS-8): This validated scale, developed by Morisky, Ang, and Krousel-Wood (2008), consists of seven binary (yes/no) items and one Likert-type item, yielding a total score range of 0–8. Scores of <6 indicate poor adherence, 6 to <8 indicate moderate adherence, and a score of 8 indicates full adherence. Moharamzad et al. (2014) reported a Cronbach's alpha of 0.697 and test–retest reliability of 0.940 for the Persian MMAS-8 in 200 Iranian patients with hypertension (16).

(c) Health Literacy for Iranian Adults (HELIA): The HELIA instrument was developed by Montazeri et al. (2014) and comprises 33 items across five domains: access to health information (6 items), reading skills (4 items), comprehension (7 items), evaluation and appraisal (4 items), and decision-making and application of health information (12 items). Responses are recorded on a five-point Likert scale. Final scores are transformed to a 0–100 scale, with cut-points of 50, 66, and 84 classifying participants into four categories: inadequate (0–50), marginally adequate (50.1–66), adequate (66.1–84), and excellent (84.1–100) health literacy. Cronbach's alpha coefficients for the subscales range from 0.72 to 0.89, with overall adequate reliability and validity (17). In the present sample, Cronbach's alpha calculated across the five HELIA domain scores was 0.88 ($n=350$), with corrected domain–total correlations of 0.47–0.89.

Questionnaires were completed in person at the health centers. Literate participants completed them by themselves (self-administered), whereas for participants who were unable to read, a trained interviewer read the questions aloud and recorded their responses. The interviewer remained present throughout to address any questions.

Statistical Analysis

Data were analyzed using SPSS version 24. Continuous variables were expressed as mean $\pm$ standard deviation or median (IQR) based on normality. Categorical variables were presented as frequencies and percentages. Non-parametric tests, including Spearman's rank correlation, Mann-Whitney U, and Kruskal-Wallis tests, were employed to examine associations between variables. A p-value of <0.05 was considered statistically significant. The normality of continuous variables was assessed using the Kolmogorov-Smirnov test (with Lilliefors correction) and the Shapiro-Wilk test. Age, disease duration, MMAS-8 score, and total HELIA score were not normally distributed (all $p < 0.001$); therefore, non-parametric tests were applied.

Results

Demographic Characteristics

The study included 350 hypertensive patients with a mean age of 56.71 ± 7.20 years (range: 36–65 years). Slightly more than half of the participants were female (51.7%, $n=181$). Education levels were generally low, with 40.0% having less than a high school education and 24.0% being illiterate. Most participants (70.3%) resided in urban areas, and 48.3% were homemakers. The mean duration of hypertension was 9.42 ± 8.31 years. Physicians and healthcare workers were the primary source of health information for 69.1% of the sample. Detailed demographic characteristics of the participants are presented in **Table 1**.

Medication Adherence

The mean MMAS-8 score was 6.16 ± 1.57 . Based on adherence categories, 38.0% ($n=133$) had poor adherence, 50.0% ($n=175$) had moderate adherence, and 12.0% ($n=42$) had full adherence (**Table 2**).

Health Literacy

The mean total HELIA score was 61.25 ± 17.34 . Analysis revealed that 31.4% ($n=110$) had inadequate and 24.0% ($n=84$) had marginally adequate health literacy (**Table 3**). Domain-specific scores were highest in the reading domain (72.63 ± 17.37) and lowest in the evaluation and appraisal domain (45.21 ± 21.83) (**Table 4**).

Table 1. Demographic characteristics of the participants ($n=350$)

Variable	Category	n (%) or Mean $\pm$ SD	Median (IQR)
Age (years)	—	56.71 ± 7.20	59.00 (11.00)
Duration of hypertension (years)	—	9.42 ± 8.31	5.50 (12.00)
Sex	Female	181 (51.7)	—
	Male	169 (48.3)	—
Education level	Illiterate	84 (24.0)	—
	Less than diploma	140 (40.0)	—

	Diploma	60 (17.1)	—
	Above diploma	66 (18.9)	—
Income level	Less than sufficient	121 (34.6)	—
	Sufficient	187 (53.4)	—
	More than sufficient	42 (12.0)	—
Occupation	Government employee / retired	139 (39.7)	—
	Self-employed	24 (6.9)	—
	Housewife	169 (48.3)	—
	Other	18 (5.1)	—
Place of residence	Urban	246 (70.3)	—
	Rural	104 (29.7)	—
Insurance type	Social Security	192 (54.9)	—
	Health Insurance	90 (25.7)	—
	Armed Forces Insurance	44 (12.6)	—
	Supplementary Insurance	12 (3.4)	—
	Other	12 (3.4)	—
Source of health information	Newspaper / magazine / booklet	12 (3.4)	—
	Radio and television	30 (8.6)	—
	Internet	42 (12.0)	—
	Physician and healthcare staff	242 (69.1)	—
	Friends	24 (6.9)	—

SD: Standard Deviation; IQR: Interquartile Range. Percentages are calculated from the total sample (N=350)

Table 2. Distribution of Medication Adherence Levels (n=350)

Adherence Level	Frequency (n)	Percentage (%)	Mean $\pm$ SD	Median
Poor (<6)	133	38.0	4.52 $\pm$ 1.24	4.75
Moderate (6 to <8)	175	50.0	6.96 $\pm$ 0.47	6.75
Full (8)	42	12.0	8.00 $\pm$ 0.00	8.00
Total	350	100.0	6.16 $\pm$ 1.57	6.75

Table 3. Health Literacy Levels among Participants (n=350)

Health Literacy Level	Frequency (n)	Percentage (%)	Mean $\pm$ SD	Median
Inadequate (0–50)	110	31.4	41.13 $\pm$ 3.99	41.40
Marginally Adequate (50.1–66)	84	24.0	56.82 $\pm$ 4.64	56.76
Adequate (66.1–84)	108	30.9	72.52 $\pm$ 4.63	72.41
Excellent (84.1–100)	48	13.7	89.73 $\pm$ 2.35	89.14
Total	350	100.0	61.25 $\pm$ 17.34	61.31

Table 4. Health literacy domain scores among participants (n=350; scores range from 0 to 100)

HELIA domain	No. of items	Mean $\pm$ SD	Min – Max
Access to health information	6	60.91 $\pm$ 26.76	25.00 – 100.00
Reading skills	4	72.63 $\pm$ 17.37	25.00 – 100.00
Comprehension	7	65.69 $\pm$ 22.82	25.00 – 100.00
Evaluation and appraisal	4	45.21 $\pm$ 21.83	12.50 – 93.75
Decision-making and application	12	61.78 $\pm$ 14.42	29.16 – 93.75
Total HELIA score	33	61.25 $\pm$ 17.34	34.82 – 93.75

SD: Standard Deviation. Cronbach's alpha across the five domain scores=0.88



Associations between Medication Adherence and Demographic Variables

Medication adherence was significantly associated with sex ($U=12156$, $Z=-3.35$, $p=0.001$), education level ($H=29.38$, $df=3$, $p<0.001$), occupation ($H=22.75$, $df=3$, $p<0.001$), insurance type ($H=24.50$, $df=4$, $p<0.001$), and the source of health information ($H=34.43$, $df=4$, $p<0.001$). Female participants, those with high school diplomas, and those who received information from healthcare workers showed higher adherence scores (**Table 5**). Adherence did not differ significantly by income level ($H=1.21$, $df=2$, $p=0.546$) or place of residence ($U=12729$, $Z=-0.07$, $p=0.941$).

Associations between Health Literacy and Demographic Variables

Health literacy was negatively correlated with age ($r=-0.48$, $p<0.001$) and positively associated with education level ($H=202.11$, $df=3$, $p<0.001$) and income ($H=122.65$, $df=2$, $p<0.001$). Urban residents also demonstrated significantly higher health literacy compared to rural residents ($U=6606$, $Z=-7.15$, $p<0.001$). Health literacy also differed by sex ($U=13333$, $Z=-2.07$, $p=0.038$), occupation ($H=27.34$, $df=3$, $p<0.001$), insurance type ($H=33.42$, $df=4$, $p<0.001$), and source of health information ($H=77.98$, $df=4$, $p<0.001$), whereas the correlation with disease duration was not significant ($r=-0.10$, $p=0.054$) (**Table 6**).

Table 5. Association between demographic variables and medication adherence score (Morisky scale) among participants

Demographic Variable	Category	Medication Adherence Score Mean (SD)	Medication Adherence Score Median (IQR)	Statistical Test	P-value
Age (years)	—	$r=-0.10$	—	Spearman correlation	$P=0.073$
Duration of underlying disease (years)	—	$r=0.17$	—	Spearman correlation	$P=0.002$
Sex	Female	6.39 (1.53)	6.75 (2.00)	Mann-Whitney U test ($U=12156$, $Z=-3.35$)	$P=0.001$
	Male	5.91 (1.56)	5.75 (1.50)		
Education level	Illiterate	6.30 (1.04)	6.25 (1.25)	Kruskal-Wallis test ($H=29.38$, $df=3$)	$P<0.001$
	Less than diploma	6.14 (1.87)	6.75 (2.75)		
	Diploma	6.88 (0.75)	7.00 (0.25)		
	Above diploma	5.36 (1.63)	5.75 (2.75)		
Income level	Less than sufficient	6.13 (1.65)	6.75 (1.75)	Kruskal-Wallis test ($H=1.21$, $df=2$)	$P=0.546$
	Sufficient	6.13 (1.56)	6.75 (1.50)		
	More than sufficient	6.36 (1.34)	6.00 (2.25)		
Occupation	Government employee / retired	5.92 (1.51)	5.75 (1.43)	Kruskal-Wallis test ($H=22.75$, $df=3$)	$P<0.001$
	Self-employed	5.94 (2.01)	6.50 (4.19)		
	Housewife	6.46 (1.52)	6.75 (1.63)		
	Other	5.42 (1.16)	5.50 (2.75)		
Place of residence	Urban	6.07 (1.70)	6.75 (1.43)	Mann-Whitney U test ($U=12729$, $Z=-0.07$)	$P=0.941$
	Rural	6.37 (1.18)	6.75 (1.25)		
Insurance type	Social Security	6.22 (1.65)	6.75 (1.81)	Kruskal-Wallis test ($H=24.50$, $df=4$)	$P<0.001$
	Health Insurance	5.90 (1.55)	6.00 (2.25)		
	Armed Forces Insurance	6.16 (1.35)	5.75 (2.00)		
	Other	7.50 (0.52)	7.50 (1.00)		
	Supplementary Insurance	5.75 (0.78)	5.75 (1.50)		
Source of health information	Newspaper / magazine / booklet	4.25 (1.57)	4.25 (3.00)	Kruskal-Wallis test ($H=34.43$, $df=4$)	$P<0.001$
	Radio and television	6.45 (1.13)	6.75 (1.25)		
	Internet	5.18 (1.74)	5.00 (3.00)		
	Physician and healthcare staff	6.43 (1.42)	6.75 (2.00)		
	Friends	5.75 (1.77)	6.75 (3.00)		



SD: Standard Deviation; IQR: Interquartile Range. Age and duration of underlying disease were assessed using Spearman's correlation coefficient (r); categorical variables were assessed using the Mann-Whitney U test (two categories) or the Kruskal-Wallis test (three or more categories)

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Table 6. Association between demographic variables and health literacy score among participants

Demographic Variable	Category	Health Literacy Score Mean (SD)	Health Literacy Score Median (IQR)	Statistical Test	P-value
Age (years)	—	r=-0.48	—	Spearman correlation	P<0.001
Duration of underlying disease (years)	—	r=-0.10	—	Spearman correlation	P=0.054
Sex	Female	59.41 (16.81)	60.00 (30.12)	Mann-Whitney U test (U=13333, Z=-2.07)	P=0.038
	Male	63.21 (17.73)	66.13 (28.96)		
Education level	Illiterate	42.08 (4.80)	41.40 (4.82)	Kruskal-Wallis test (H=202.11, df=3)	P<0.001
	Less than diploma	60.37 (15.06)	60.77 (21.37)		
	Diploma	67.84 (9.21)	67.14 (9.88)		
	Above diploma	81.50 (9.48)	87.50 (14.52)		
Income level	Less than sufficient	49.83 (13.78)	44.11 (19.64)	Kruskal-Wallis test (H=122.65, df=2)	P<0.001
	Sufficient	63.63 (15.04)	66.13 (22.26)		
	More than sufficient	83.50 (7.70)	87.50 (14.52)		
Occupation	Government employee / retired	64.53 (17.54)	67.08 (29.52)	Kruskal-Wallis test (H=27.34, df=3)	P<0.001
	Self-employed	73.67 (18.64)	75.27 (39.42)		
	Housewife	56.44 (14.88)	53.75 (26.52)		
	Other	64.46 (21.60)	69.17 (50.78)		
Place of residence	Urban	65.48 (16.36)	66.78 (24.46)	Mann-Whitney U test (U=6606, Z=-7.15)	P<0.001
	Rural	51.22 (15.42)	46.25 (20.54)		
Insurance type	Social Security	60.78 (16.08)	61.10 (27.32)	Kruskal-Wallis test (H=33.42, df=4)	P<0.001
	Health Insurance	66.90 (17.91)	69.17 (28.34)		
	Armed Forces Insurance	51.08 (14.33)	46.25 (31.98)		
	Other	73.54 (20.67)	73.54 (39.58)		
	Supplementary Insurance	51.25 (16.54)	51.25 (31.67)		
Source of health information	Newspaper / magazine / booklet	66.35 (5.14)	66.35 (9.84)	Kruskal-Wallis test (H=77.98, df=4)	P<0.001
	Radio and television	72.49 (10.50)	74.58 (7.86)		
	Internet	77.52 (13.62)	77.38 (22.02)		
	Physician and healthcare staff	55.99 (15.71)	52.38 (25.40)		
	Friends	69.15 (21.76)	74.61 (45.50)		



SD: Standard Deviation; IQR: Interquartile Range. Age and duration of underlying disease were assessed using Spearman's correlation coefficient (r); categorical variables were assessed using the Mann-Whitney U test (two categories) or the Kruskal-Wallis test (three or more categories).

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Association between Health Literacy and Medication Adherence

Spearman's rank correlation coefficient analysis demonstrated a statistically significant, positive association between total health literacy score and medication adherence score ($r=0.114$, $p=0.033$). This finding indicates that as the level of health literacy increases, medication adherence correspondingly improves. Although statistically significant, the correlation was weak (shared variance $\approx 1.2\%$). Among the HELIA domains, only decision-making and application was significantly correlated with medication adherence ($r=0.41$, $p<0.001$); the correlations for reading ($r=0.07$, $p=0.178$), access ($r=0.08$, $p=0.135$), comprehension ($r=0.05$, $p=0.359$), and evaluation and appraisal ($r=-0.06$, $p=0.255$) were not significant (**Table 7**).

Table 7. Spearman correlations between health literacy domains and medication adherence (MMAS-8) score (n=350)

HELIA domain	No. of items	Spearman r with MMAS-8	P-value
Access to health information	6	0.080	0.135
Reading skills	4	0.072	0.178
Comprehension	7	0.049	0.359
Evaluation and appraisal	4	-0.061	0.255
Decision-making and application	12	0.409	<0.001
Total HELIA score	33	0.114	0.033

Spearman's rank correlation coefficient (r). MMAS-8: Morisky Medication Adherence Scale-8.

Discussion

The present cross-sectional study investigated health literacy levels, medication adherence, and their interrelationship among 350 hypertensive patients in Gonabad City, Iran. Adherence was predominantly moderate, more than half of participants had inadequate or marginally adequate health literacy, and the two were significantly and positively associated. These findings indicate that the central challenge in this population is not simply whether patients have been prescribed antihypertensive medication, but whether they possess the skills needed to interpret, evaluate, and apply treatment information consistently in daily life.

The adherence pattern observed in Gonabad is consistent with the broader literature showing that long-term antihypertensive treatment remains difficult to sustain, with only 12.0% of participants demonstrating full adherence. Comparable difficulties have been reported in Chinese hypertensive patients (18, 19), and a systematic review of medication adherence in low- and middle-income countries estimated non-adherence to antihypertensive treatment at approximately 45.2%–66.7% (20). This is clinically important because non-adherence reduces the effectiveness of otherwise appropriate therapy and has been associated with uncontrolled blood pressure, increased cardiovascular risk, avoidable healthcare expenditure, and poorer quality of life (20-22); adherence has also been linked to achieving blood-pressure goals (23). The moderate adherence observed in Gonabad may therefore represent an important clinical vulnerability.



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Health literacy was also suboptimal in the Gonabad sample, with the lowest performance in evaluation and appraisal of health information, suggesting that the most relevant deficit may not be the ability to read health material but the ability to judge its reliability and translate it into an appropriate treatment decision (17). This distinction is important because its dimensions may contribute differently to medication-taking behavior (6, 24).

Our findings are broadly consistent with Iranian evidence from Heris County (11) and Sarab (12). The similarity between these Iranian studies suggests that inadequate health literacy may be a recurrent feature of hypertension management in Iranian communities, although the different instruments and population structures prevent direct comparison of prevalence estimates (11, 12).

The significant positive association between health literacy and medication adherence in Gonabad supports the principal hypothesis of the study. The magnitude of the association was modest, indicating that health literacy is relevant but cannot by itself account for the full complexity of adherence. Similar positive associations have been reported in a Turkish hypertensive sample, in which health literacy explained 29.7% of the variance in medication adherence (25). The domain-level analysis adds some detail: only decision-making and application correlated appreciably with adherence ($r=0.41$, $p<0.001$), whereas reading, access, comprehension, and evaluation and appraisal did not (all $p>0.1$; Table 7). This suggests that the practical ability to apply health information to treatment decisions, rather than the ability to find or read it, may matter most for taking medication regularly, although this cross-sectional finding needs confirmation.

The association may operate through several related pathways. Patients with stronger health literacy may be better able to understand why antihypertensive medication is necessary despite the absence of symptoms, distinguish medicines by indication, interpret dose and timing instructions, recognize adverse effects, and communicate uncertainties to clinicians (8). Health literacy may therefore influence adherence partly by reducing unintentional non-adherence caused by misunderstanding, medication-list discrepancies, or incorrect self-administration rather than only by changing motivation. In Chinese hypertensive patients, medication literacy was positively associated with adherence, particularly through the attitude and behavior domains (18). These findings suggest that general education alone does not guarantee consistent treatment behavior: a patient may have adequate formal schooling yet remain uncertain about the purpose, risks, or practical administration of several antihypertensive medicines (8, 18).

The present findings should also be considered alongside evidence that the health-literacy-adherence relationship is not invariably positive, as described in the Introduction for the Chicago study (14) and the review of older adults (13). The Vietnamese study linking health literacy to blood-pressure control via self-care behavior was also limited by its cross-sectional, single-hospital design (26). These findings indicate that adherence is a multidimensional behavior influenced by medication burden, beliefs about illness and treatment, social

support, access to care, depression, costs, regimen complexity, and the quality of communication with healthcare professionals (3, 9).

The demographic findings in Gonabad also require careful interpretation. Lower health literacy has been associated with older age, less education, lower income, and (in one study of older adults) rural residence, whereas sex differences appear context-dependent (27). In Heris, men and women differed across health-literacy domains (11). Because such differences vary across settings, the Gonabad pattern should not be read as an inherent difference in capability; it may instead reflect unequal educational opportunities, social roles, and access to information (11, 28).

Disease duration was positively associated with adherence but not significantly with health literacy, which may indicate that treatment experience can increase routine familiarity or perceived necessity without necessarily improving the broader ability to evaluate health information (12). Conversely, longer exposure to hypertension may produce treatment fatigue, polypharmacy, or reduced motivation in some populations (13). The direction of this relationship therefore appears context-dependent.

Study Limitations and Strengths: This study has several limitations that should be acknowledged. First, the cross-sectional design precludes causal inference between health literacy and medication adherence. Second, both health literacy and medication adherence were self-reported, introducing the possibility of social desirability bias—particularly for medication adherence assessment. Third, the convenience sampling approach within each stratum may limit generalizability beyond the Gonabad health center population.

Conclusion

Hypertensive patients in Gonabad face substantial challenges regarding both health literacy and medication adherence. The weak but significant association between these factors suggests that health literacy may be one of several factors relevant to medication adherence, although causality cannot be inferred from this cross-sectional design. Healthcare providers should focus on clear communication and the provision of simplified, high-quality health information, particularly for older adults and those with lower educational levels. Future interventions should move beyond simple information delivery to fostering critical appraisal skills among patients to ensure they can effectively manage their treatment regimens.

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Consent for publication: Not applicable.

Ethics approval and consent to participate: The study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki. Consent forms were filled out prior to participation in the study, and the treatment of those who did not participate was not altered. The researcher also explained this study's steps and process to all of the participants and that their anonymity and data confidentiality will be maintained throughout the study. The study was approved by the Ethics Committee of Gonabad University of Medical Sciences (Ethical Code: IR.GMU.REC.1401.195). Data were anonymized and stored securely, accessible only to the research team.

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