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Adherence to a Traditional Iranian Medicine Lifestyle and Its Predictors

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Title

Adherence to a Traditional Iranian Medicine Lifestyle and Its Predictors

Running Title: TIM Lifestyle and Its Predictors

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Abstract:

Background and Objectives: To quantify adherence to a Traditional Iranian Medicine (TIM) lifestyle across its six behavioral domains and identify independent predictors using multivariable modeling. Methods: In this 2025 cross-sectional study, 2,522 adults (mean age 39.6 ± 10.3 years; 52.4% female) were randomly sampled from the SINA database. Lifestyle was measured via a 44-item questionnaire with confirmed high internal reliability. Multivariate linear regression, guided by Likelihood Ratio Tests (LRT), was applied to the total score and each domain independently. Results: Non-communicable disease (NCD) prevalence was 29.6%. Multivariate models revealed distinct domain-specific predictors. Female gender consistently predicted higher scores in Eating and Drinking (β = 2.04, $P < 0.001$), Retention and Evacuation (β = 0.40, $P = 0.003$), and Sleep (β = 0.3, $P = 0.005$). Increasing age was a positive cross-domain predictor, most strongly driving Eating and Drinking (β = 0.18, $P < 0.001$). Conversely, higher education uniquely predicted Exercise and Rest (β = 2.0, $P <$ 0.001) but not other domains. Parity showed a trade-off: positively predicting the total score (β = 1.6,

P = 0.002) while negatively predicting Weather and Seasons (β = -0.3, P < 0.001) and Exercise (β = -0.1, P = 0.020). Conclusion: TIM lifestyle adherence is highly domain-specific. While age and female gender broadly drive adherence, education and parity exhibit isolated, contrasting effects across different behavioral domains, highlighting the need for targeted, dimension-specific public health interventions.

Key-words:

Medicine, Iranian Traditional, Lifestyle, Chronic Diseases, Preventive Health Services

Introduction:

The global health landscape is currently navigating a profound epidemiological transition, characterized by a shift in the burden of disease from infectious illnesses to chronic non-communicable diseases (NCDs). According to the World Health Organization, NCDs now account for an estimated 74% of all global mortality, imposing a substantial socioeconomic burden on societies worldwide [1, 2]. Reflecting this global trend, Iran is confronting a surge in continuous chronic conditions, particularly cardiovascular diseases and diabetes, which have emerged as the leading causes of death in the country [3]. In this context, lifestyle has been appropriately positioned as a central, modifiable risk factor in strategies for the prevention and control of these conditions [4, 5].

Alongside conventional biomedical approaches, Traditional Iranian Medicine (TIM) offers a comprehensive and holistic paradigm for health maintenance [6, 7]. This paradigm posits that health is not recognizably the absence of disease, but rather a state of dynamic equilibrium among the body's fundamental elements, which is profoundly influenced by environmental and behavioral factors [7]. A cornerstone of TIM is the concept of "Hifz al-Sehha" (preservation of health), which emphasizes proactive disease prevention. The practical framework for this approach is the "Setta-e Zarooriyeh" (Six Essentials of Life): 1) Weather and Seasons, 2) Eating and Drinking, 3) Retention and Evacuation, 4) Exercise and Rest, 5) Sleep and Wakefulness, and 6) Mental States. Adherence to the principles governing these six domains is considered the foundation of maintaining physiological balance and preventing illness [8].

Despite its deep historical roots and cultural embeddedness in Iran, a significant gap remains in the contemporary scientific literature. There is a lack of systematic, quantitative research evaluating adherence to these principles in modern populations and, critically, investigating their association with clinical health outcomes such as NCDs. This evidentiary gap impedes the effective translation of traditional knowledge into modern public health policies and integrated healthcare interventions.

To bridge this gap, the present study was designed to provide an epidemiological evaluation of TIM lifestyle principles. Leveraging unique access to comprehensive population-based data from the Mashhad University of Medical Sciences, this study provides a robust opportunity to analyze these behaviors at a large scale. The study was conducted with the following specific objectives: 1) To quantitatively assess the level of adherence to the six domains of the TIM lifestyle; 2) To determine the association between the composite lifestyle score and the prevalence of chronic diseases; and 3) To identify the demographic and clinical predictors associated with adherence to this traditional lifestyle framework.

Methodology

Study Design and Population This cross-sectional analytical study was conducted in 2025, targeting a population aged 18 to 70 years residing in the districts covered by the Mashhad University of Medical Sciences.

Sampling and Sample Size The integrated health information system (SINA), which contains data for over 95% of individuals over 18 years who visited comprehensive health centres for COVID-19 vaccination during the pandemic, served as our sampling frame. This feature provided access to a near-complete enumeration of the target population, thereby substantially minimizing selection bias. Participants were selected via a simple random sampling method. The final analytical sample size, adjusted for inaccessible individuals and those who declined to participate, was 2,522. Inclusion criteria comprised providing informed consent and being within the specified age range.

Data Collection Data were collected via telephone interviews conducted by two trained interviewers. All research procedures were conducted in accordance with the Declaration of Helsinki. A two-part self-report questionnaire was administered. The first part captured the demographic and clinical characteristics of the participants, including the presence of chronic conditions. The core component was the Traditional Iranian Medicine Lifestyle Questionnaire (TIMLQ), designed based on the concept of "Setta-e Zarooriyeh" (Six Essentials of Life). This instrument comprised 44 items categorized into six domains: Weather and Seasons (9 items), Exercise and Rest (3 items), Sleep and Wakefulness (5 items), Eating and Drinking (14 items), Retention and Evacuation (6 items), and Mental States (7 items). *(The English version of the TIMLQ is provided in Supplementary File 1).*

Instrument Validation

The psychometric properties of the TIMLQ were evaluated prior to the main analysis. Internal consistency was high, with Cronbach's alpha coefficients exceeding 0.80 across all subscales. Construct validity was assessed using exploratory factor analysis (EFA). The results indicated that while the items generally clustered according to their theoretical domains, the factor structure did not reach an optimal statistical fit. This is an expected methodological challenge in traditional medicine questionnaires, where behavioral domains (e.g., dietary habits and sleep hygiene) are inherently interrelated rather than mutually exclusive. Consequently, the total scores are interpreted as an aggregated index of traditional lifestyle adherence rather than strictly independent dimensional scores. Although the instrument requires further validation using confirmatory factor analysis in future studies, the high internal reliability supports the stability of the scores for the purposes of this specific epidemiological analysis.

Scoring System Each item was assessed using a five-point Likert scale (from 'Always' to 'Never'). To ensure a consistent interpretation where higher scores indicate greater adherence to traditional medicine principles, items reflecting unhealthy behaviors (e.g., consumption of fast food or sleeping in front of a fan) were reverse-scored. A total score was subsequently calculated for each of the six domains, as well as an overall total lifestyle score.

Statistical Analysis All statistical analyses were performed using Stata (version 18; Stata Corp, College Station, TX, USA). Descriptive statistics, including mean ± standard deviation for quantitative variables and frequency (percentage) for categorical variables, were calculated. To compare lifestyle scores across different groups, independent samples t-tests were used for binary

variables, and one-way analysis of variance (ANOVA) was applied for categorical variables with more than two levels, following appropriate checks for the normality of data distribution.

To identify independent predictors of lifestyle scores, multivariate linear regression modeling was employed. Variables yielding a P-value < 0.2 in the univariate analyses were initially considered as candidates for inclusion in the multivariable models to avoid omitting potential confounders [9]. Rather than relying solely on individual P-values for final variable retention, model specification and selection were rigorously guided by Likelihood Ratio Tests (LRT). This approach compares nested models to assess whether the removal of a specific covariate significantly degrades the overall model fit. Consequently, the final multivariable models retain certain covariates that, while not reaching the traditional $\alpha = 0.05$ threshold for independent significance, were mathematically justified by LRT due to their collective contribution to the model's explanatory power and the prevention of residual confounding. A two-sided P-value of less than 0.05 was considered statistically significant for evaluating the primary independent effects of the predictors.

Results

Demographic and Clinical Profile of the Study Cohort

The final analytical sample consisted of 2,522 adults (47.6% male). The mean age of the cohort was 39.6 years (SD = 10.3), with participants ranging from 18 to 70 years. As summarized in Table 1, the sociodemographic landscape of this population was characterized by a high proportion of married individuals (88.9%) and an urban predominance (82.1%). Educational attainment was relatively distributed, though more than half of the sample (57.1%) had completed at least a high school diploma or attained a university degree. In terms of occupational distribution, the cohort was nearly evenly split between self-employment (39.9%) and homemaking (40.4%), with formal employment accounting for 15.7%.

Beyond demographics, a notable clinical feature of this cohort was the prevalence of chronic morbidity. Nearly one-third of the participants (29.6%; n = 748) reported a history of at least one chronic condition. A closer examination of the disease spectrum revealed hypertension as the leading diagnosis, affecting 11.7% (n = 295) of the total sample. This was closely followed by musculoskeletal disorders (10.3%; n = 260). Metabolic and vascular pathologies were also apparent, with diabetes and coronary heart disease (CHD) reported by 6.5% (n = 165) and 5.0% (n = 125) of individuals, respectively. Furthermore, non-communicable diseases extending beyond the traditional cardiovascular-metabolic spectrum—specifically thyroid dysfunction (6.1%; n = 154), psychological disorders (4.2%; n = 105), and renal diseases (3.5%; n = 89)—contributed substantially to the overall disease burden. These baseline characteristics highlight a demographic intersection where relatively young to middle-aged adults are already experiencing a measurable shift toward non-communicable diseases.

Table 1. Demographic Characteristics of Participants (N = 2522)

Variable	Categories	Frequency	Percentage (%)
Gender	Male	1201	47.6
	Female	1321	52.4

Variable	Categories	Frequency	Percentage (%)
Marital Status	Married	2241	88.9
	Single	189	7.5
	Divorced	92	3.6
Employment Status	Employee	397	15.7
	Self-employed	1007	39.9
	Homemaker	1020	40.4
	Other (Unemployed, Retired, Disabled)	98	3.9
Education Level	Illiterate	80	3.2
	Primary school	462	18.6
	Middle school	524	21.1
	High school diploma	779	31.3
	University/College degree	640	25.8
Residence	Urban	2070	82.1
	Rural	452	17.9
Chronic Disease	Yes	748	29.6
	No/ Unknow	1776	70.4
Age (years)	Mean ± SD	39.58 ± 10.28	(Range: 18-70)
Number of Children	Mean ± SD	2.06 ± 1.43	(Range: 0-13)

Lifestyle Indicators and Data Distribution

Descriptive statistics for the lifestyle domains are presented in Table 2. The mean total lifestyle score for the cohort was 162.9 ± 15.5 (range: 128.0–210.0 out of a maximum possible score of 210). Domain-specific analysis revealed that the highest mean score was attributed to Eating and Drinking (49.2 ± 6.4), while the lowest mean score was observed for Exercise and Rest (11.2 ± 2.6). The remaining domains demonstrated moderate mean scores, including Mental States (32.7 ± 5.1), Weather and Seasons (30.8 ± 4.4), Sleep and Wakefulness (18.7 ± 3.1), and Retention and Evacuation (19.6 ± 3.1).

Visual inspection of the data distributions via box plots indicated significant departures from normality across multiple domains, characterized by pronounced skewness and the presence of outliers. Specifically, the Eating and Drinking, Weather and Seasons, and Sleep and Wakefulness domains demonstrated left-skewed distributions. In these domains, outliers were clustered predominantly in the lower tail, pointing to a distinct subset of participants with substantially low adherence scores. Conversely, the Retention and Evacuation domain displayed a bimodal distribution of outliers at both extremes, suggesting polarized behavioral patterns within the sample. A comparable pattern of extreme outlier distribution was noted in the Mental States domain, reflecting substantial inter-individual variability in psychological well-being metrics across the cohort.

These distributional patterns are visually delineated in Figure 1. The box plots illustrate the median scores and interquartile ranges (IQR) for each domain, confirming the statistical outliers identified in the numerical analysis. Notably, the visual representation starkly contrasts the compressed, negatively skewed distribution of the Eating and Drinking domain against the wider, bimodal spread observed in the Retention and Evacuation and Mental States domains.

Table 2. Descriptive Statistics for Lifestyle Component Scores

Lifestyle Component	Mean ± SD	Range
Weather and Seasons	30.8 ± 4.4	13.0 – 43.0
Exercise and Rest	11.2 ± 2.6	4.0 – 15.0
Sleep and Wakefulness	18.7 ± 3.1	5.0 – 25.0
Eating and Drinking	49.2 ± 6.4	25.0 – 68.0
Retention and Evacuation	19.6 ± 3.1	9.0 – 30.0
Mental States	32.7 ± 5.1	17.0 – 45.0
Total Lifestyle Score	162.9 ± 15.5	128.0 – 210.0

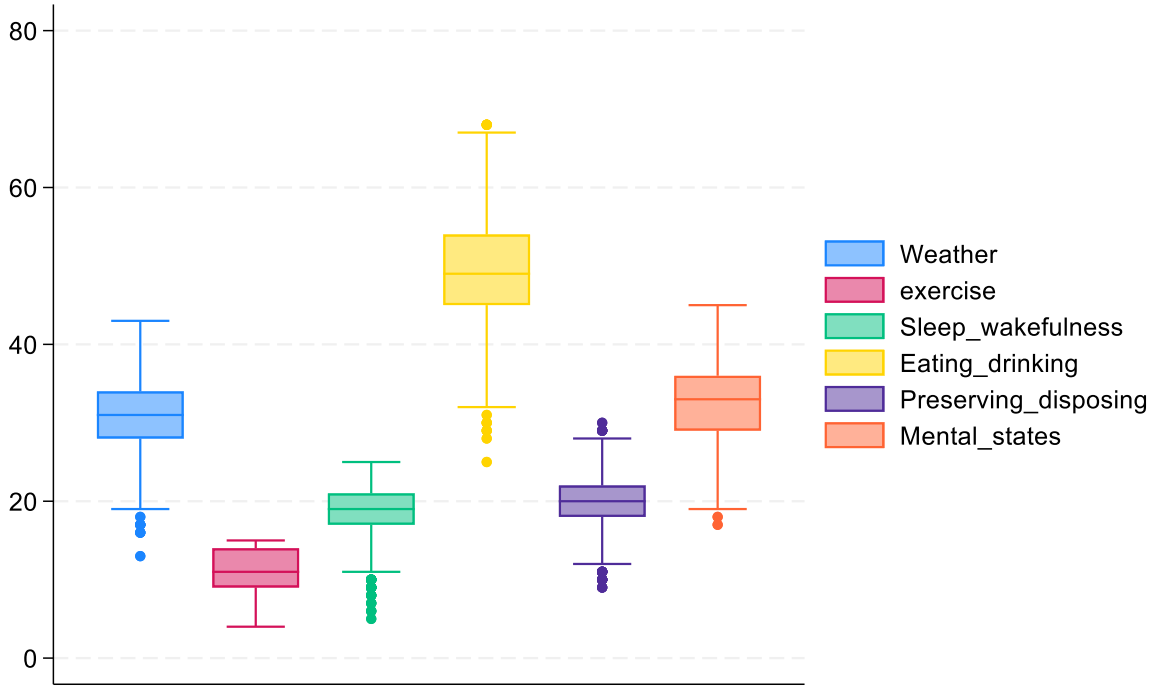


Figure 1Distribution of Scores Across Lifestyle Components.

(Box plot showing the median, interquartile range (IQR), and outliers for the scores of each lifestyle component and the total score. The horizontal line within each box represents the median score, while the box boundaries represent the first (Q1) and third (Q3) quartiles. Whiskers extend to the highest and lowest values within 1.5 times the IQR).

Comparison of Lifestyle Scores Across Demographic, Clinical, and Continuous Variables

To identify potential determinants of lifestyle behaviors, bivariate and multivariable analyses were conducted, with results detailed in Table 3. Independent samples t-tests (Part A) revealed significant gender disparities; females achieved significantly higher total lifestyle scores compared to males (165.1 vs. 160.0, $P = 0.001$), an advantage that was consistently reflected in the Weather and Seasons, Sleep and Wakefulness, and Eating and Drinking domains. Residential setting exhibited a distinct domain-specific pattern: urban dwellers scored significantly higher in Exercise and Rest (11.4 vs. 10.5, $P < 0.001$), whereas rural residents demonstrated superior scores in Retention and Evacuation (20.5 vs. 19.5, $P < 0.001$).

Perhaps the most clinically notable finding in Part A was the impact of chronic morbidity. Contrary to initial expectations, participants reporting at least one chronic disease demonstrated significantly higher total lifestyle scores and better domain-specific adherence (including Exercise, Sleep, and Eating) compared to their healthy counterparts ($P < 0.001$ for all relevant domains), suggesting a potential shift toward health-promoting behaviors following diagnosis.

Further stratification using one-way ANOVA (Part B) elucidated the effects of socioeconomic factors. Marital status significantly influenced the total score ($P = 0.001$), with single individuals consistently scoring lower, particularly in Eating and Drinking and Mental States, while divorced individuals reported the highest scores in certain dietary and sleep domains. Educational attainment presented a complex, non-linear relationship; while illiterate participants frequently exhibited higher scores in traditional domains (like Weather and Seasons) compared to some educated subgroups, formal education did not linearly predict a higher total lifestyle score ($P = 0.534$). Employment status was a significant predictor ($P = 0.017$), with homemakers achieving the highest total scores, whereas formally employed individuals scored highest specifically in Exercise and Rest.

Finally, linear regression analysis (Part C) clarified the continuous demographic drivers. Increasing age was significantly and positively associated with higher total lifestyle scores ($\beta = 0.24$, $P = 0.007$),

driven primarily by improvements in Exercise, Sleep, and Eating behaviors. The relationship with parity (number of children) was more complex. While having more children was positively associated with the total score ($\beta = 2.02$, $P < 0.001$) and better Eating and Retention scores, it was paradoxically linked to significantly lower scores in the Weather and Seasons and Exercise domains ($\beta = -0.15$ and -0.17, respectively; $P < 0.005$). This highlights a specific behavioral trade-off, indicating that while parenthood may encourage certain routine-based lifestyle practices, it simultaneously introduces notable barriers to physical activity and outdoor environmental exposure.

Table 3. Sociodemographic and Clinical Determinants of Lifestyle Scores

Part A: Independent Samples T-test for Binary Variables (Gender, Residence, Chronic Disease)

Component	Variable	Group	Mean ± SD	t-value	p-value
Total Lifestyle Score	Gender	Male	160.0 ± 14.3	3.2	0.001
		Female	165.1 ± 16.1		
	Residence	Urban	162.1 ± 15.7	1.6	0.109
		Rural	165.1 ± 14.6		
	Chronic Disease	Yes	169.0± 18.0	-3.83	0.000
		No	161.4± 14.5		
Weather and Seasons	Gender	Male	.4 ± 4.5	3.1	0.002
		Female	31.0 ± 4.4		
	Residence	Urban	30.8 ± 4.4	0.8	0.393
		Rural	30.6 ± 4.5		
	Chronic Disease	Yes	31.4± 4.3	-4.3	0.000
		No	30.5± 4.5		
Exercise and Rest	Gender	Male	11.3 ± 2.6	1.5	0.124
		Female	11.2 ± 2.5		
	Residence	Urban	11.4 ± 2.6	5.8	<0.001
		Rural	10.5 ± 2.2		
	Chronic Disease	Yes	11.7± 2.5	-3.8	0.000
		No	11.15± 2.62		
Sleep and Wakefulness	Gender	Male	18.5 ± 3.2	-2.9	0.004

Component	Variable	Group	Mean ± SD	t-value	p-value
		Female	18.9 ± 3.1		
	Residence	Urban	18.7 ± 3.1	0.9	0.342
		Rural	18.8 ± 3.2		
	Chronic Disease	Yes	19.0± 3.0	-3.3	0.000
		No	18.6± 3.2		
Eating and Drinking	Gender	Male	48.3 ± 6.1	-6.3	0.000
		Female	50.0 ± 6.5		
	Residence	Urban	49.3 ± 6.4	1.8	0.064
		Rural	48.7 ± 6.2		
	Chronic Disease	Yes	50.5± 6.5	-6.8	0.000
		No	48.6± 6.3		
Retention and Evacuation	Gender	Male	19.5 ± 3.0	-1.6	0.103
		Female	19.7 ± 3.2		
	Residence	Urban	19.5 ± 3.1	-6.61	0.000
		Rural	20.5 ± 3.1		
	Chronic Disease	Yes	19.5± 3.2	1.8	0.069
		No	19.7± 3.1		
Mental States	Gender	Male	32.3 ± 5.1	1.4	0.153
		Female	33.0 ± 5.0		
	Residence	Urban	32.9 ± 5.1	1.4	0.162
		Rural	32.2 ± 4.9		
	Chronic Disease	Yes	32.8± 5.9	-0.2	0.839
		No	32.7± 4.8		

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Note: Independent samples t-test was used. P-values in bold indicate statistical significance ($p < 0.05$). The "0.00" values from the original table are represented as their precise statistical meaning (e.g., $p < 0.001$).

Table 3. Sociodemographic and Clinical Determinants of Lifestyle Scores

Part B: One-Way ANOVA for Categorical Variables (Marital Status, Education, Employment)

Component	Variable	Group	Mean ± SD	Coefficient	F-value	p-value
Total Lifestyle Score	Marital Status	Married	163.9 ± 15.3	1	6.6	0.001
		Single	155.3 ± 15.1	8.5		
		Divorced	165.0 ± 15.1	9.6		
	Education Level	Illiterate	165.0 ± 17.4	1	0.7	0.534
		Primary school	162.5 ± 14.9	-7.9		
		Middle school	161.7 ± 14.2	-8.9		
		High school diploma	164.1 ± 17.3	-9.6		
		University degree	161.7 ± 14.5	-9.0		
	Employment Status	Employee	160.3 ± 17.9	1	3.4	0.017
		Self-employed	161.3± 14.4	.9		
		Homemaker	165.8± 15.2	5.5		
		Other*	159.3± 14.7	-1.0		
Weather and Seasons	Marital Status	Married	30.8 ± 4.4	1	5.3	0.005
		Single	29.8 ± 4.3	1.0		
		Divorced	30.3 ± 4.5	.5		
	Education Level	Illiterate	30.0 ± 4.9	1	17.3	.00
		Primary school	31.3 ± 4.3	.4		
		Middle school	30.5 ± 4.4	1.0		

Component	Variable	Group	Mean ± SD	Coefficient	F-value	p-value
		High school diploma	30.6 ± 4.5	1.4		
		University degree	30.7 ± 4.4	2.5		
	Employment Status	Employee	31.8± 4.4	1	10.1	0.000
		Self-employed	30.3± 4.5	-1.4		
		Homemaker	30.8± 4.4	-.9		
		Other*	30.7± 4.7	-1.0		
Exercise and Rest	Marital Status	Married	11.3 ± 2.6	1	0.0	0.949
		Single	11.2 ± 2.6	.0		
		Divorced	11.2 ± 2.5	-.0		
	Education Level	Illiterate	11.3 ± 3.0	1	29.3	0.00
		Primary school	11.2 ± 2.6	.1		
		Middle school	11.3 ± 2.6	.2		
		High school diploma	11.1 ± 2.6	.8		
		University degree	11.3 ± 2.5	1.8		
	Employment Status	Employee	12.2± 2.6	1	17.1	0.000
		Self-employed	11.1± 2.5	-1.1		
		Homemaker	11.0± 2.5	-1.2		
		Other*	11.5± 2.7	-.7		
Sleep and Wakefulness	Marital Status	Married	18.7 ± 3.1	1	5.0	0.006
		Single	18.0 ± 3.2	.7		
		Divorced	19.0 ± 3.0	.9		

Component	Variable	Group	Mean ± SD	Coefficient	F-value	p-value
	Education Level	Illiterate	18.2 ± 3.0	1	1.62	0.165
		Primary school	18.9 ± 3.2	.1		
		Middle school	18.9 ± 3.1	-.0		
		High school diploma	18.6 ± 3.0	.1		
		University degree	18.5 ± 3.2	.4		
	Employment Status	Employee	19.2± 3.2	1	5.69	0.000
		Self-employed	18.5± 3.2	-.7		
		Homemaker	18.8± 3.0	-.4		
		Other*	18.4± 2.8	-.8		
Eating and Drinking	Marital Status	Married	49.3 ± 6.3	1	14.9	0.000
		Single	46.9 ± 6.4	2.4		
		Divorced	50.8 ± 7.1	3.9		
	Education Level	Illiterate	48.5 ± 7.3	1	4.2	0.001
		Primary school	49.7 ± 6.3	-.2		
		Middle school	49.2 ± 6.3	-1.0		
		High school diploma	48.9 ± 6.3	-.8		
		University degree	48.7 ± 6.4	.2		
	Employment Status	Employee	49.7± 6.3	1	12.7	0.000
		Self-employed	48.3 ± 6.1	-1.3		
		Homemaker	49.9 ± 6.5	.2		
		Other*	47.8± 6.8	-1.9		

Component	Variable	Group	Mean ± SD	Coefficient	F-value	p-value
Retention and Evacuation	Marital Status	Married	19.7 ± 3.1	1	2.3	0.094
		Single	19.2 ± 3.2	.52		
		Divorced	19.6 ± 3.4	.4		
	Education Level	Illiterate	19.6 ± 2.8	1	2.6	0.030
		Primary school	19.6 ± 3.2	.5		
		Middle school	19.6 ± 3.2	.8		
		High school diploma	19.6 ± 3.0	.6		
		University degree	19.7 ± 3.0	.2		
	Employment Status	Employee	19.5 ± 3.0	1	3.9	0.007
		Self-employed	19.5 ± 3.0	.0		
		Homemaker	19.9 ± 3.2	.4		
		Other*	19.0± 3.3	-.4		
Mental States	Marital Status	Married	33.0 ± 5.0	1	5.4	0.004
		Single	31.2 ± 5.3	1.8		
		Divorced	29.9 ± 5.1	-1.2		
	Education Level	Illiterate	33.4 ± 5.1	1	2.2	0.060
		Primary school	31.7 ± 5.4	-.3		
		Middle school	32.9 ± 4.5	.5		
		High school diploma	32.9 ± 5.1	.9		
		University degree	32.7 ± 5.4	1.7		
	Employment Status	Employee	32.0± 5.3	1	1.2	0.286

Component	Variable	Group	Mean ± SD	Coefficient	F-value	p-value
		Self-employed	32.± 5.3	.5		
		Homemaker	33.0± 4.9	.9		
		Other*	34.1± 4.5	2.0		

Note: One-way Analysis of Variance (ANOVA) was used for each variable. The F-value and p-value in each row correspond to the overall statistical test for that variable. P-values in bold indicate statistical significance ($p < 0.05$). **Other category includes Unemployed, Job seeker, Retired, and Disabled participants.*

Table 3. Sociodemographic and Clinical Determinants of Lifestyle Scores
Part C: Linear Regression Analysis for Continuous Variables (Age, Number of Children)

Component	β (Age)	p-value	95% CI for β
Total Lifestyle Score	0.24	0.007	0.07 to 0.41
Weather and Seasons	0.01	0.064	-0.00 to 0.03
Exercise and Rest	0.02	<0.001	0.01 to 0.03
Sleep and Wakefulness	0.02	<0.001	0.01 to 0.03
Eating and Drinking	0.16	<0.001	0.13 to 0.19
Retention and Evacuation	0.02	0.001	0.00 to 0.03
Mental States	-0.01	0.462	-0.07 to 0.03

Component	β (Number of Children)	p-value	95% CI for β
Total Lifestyle Score	2.02	<0.001	0.97 to 3.07
Weather and Seasons	-0.17	0.005	-0.30 to -0.05
Exercise and Rest	-0.15	<0.001	-0.24 to -0.06
Sleep and Wakefulness	0.08	0.042	0.00 to 0.17
Eating and Drinking	0.56	<0.001	0.38 to 0.73
Retention and Evacuation	0.15	0.001	0.06 to 0.23
Mental States	0.22	0.172	-0.09 to 0.55

Note: Linear regression analysis was performed. β = Unstandardized regression coefficient. CI = Confidence Interval. P-values in bold indicate statistical significance (p < 0.05).

Multivariate Regression Analysis of Independent Predictors

To identify the independent predictors of lifestyle scores, multivariate linear regression models were constructed. Rather than relying solely on individual P-values for variable retention, model specification was rigorously guided by Likelihood Ratio Tests (LRT) to ensure optimal model fit. Consequently, the final models retain certain covariates that, while not statistically significant at the $\alpha = 0.05$ level in the multivariable context, were mathematically justified by LRT due to their collective contribution to the model's explanatory power and prevention of residual confounding. The comprehensive results are detailed in Table 4.

Total Lifestyle Score The final optimized model for the overall lifestyle score identified female gender ($\beta = 4.4$, $P = 0.004$) and a greater number of children ($\beta = 1.6$, $P = 0.002$) as the primary significant positive predictors. Rural residence was retained in this final model based on LRT criteria; although its independent coefficient did not reach statistical significance ($P = 0.381$), its inclusion was necessary to maintain the integrity and fit of the overall predictive model.

Domain-Specific Predictors: Positive Associations A more nuanced pattern emerged when analyzing the individual lifestyle domains (Table 4), where the predictive power of variables was distinctly isolated. Female gender and increasing age consistently emerged as robust positive predictors across multiple dimensions. Being female was significantly associated with higher scores in Sleep and Wakefulness ($\beta = 0.3$, $P = 0.005$), Eating and Drinking ($\beta = 2.04$, $P < 0.001$), and Retention and Evacuation ($\beta = 0.40$, $P = 0.003$). Similarly, increasing age was positively linked to higher adherence in Weather and Seasons ($\beta = 0.04$, $P < 0.001$), Exercise and Rest ($\beta = 0.04$, $P < 0.001$), Sleep and Wakefulness ($\beta = 0.03$, $P < 0.001$), Eating and Drinking ($\beta = 0.18$, $P < 0.001$), and Retention and Evacuation ($\beta = 0.03$, $P < 0.001$).

Educational attainment demonstrated a significant positive, dose-response relationship within specific behavioral domains. Compared to illiterate individuals, holding a university degree was a significant independent predictor for Weather and Seasons ($\beta = 2.1$, $P < 0.001$), Exercise and Rest ($\beta = 2.0$, $P < 0.001$), Sleep ($\beta = 0.8$, $P = 0.032$), and Eating and Drinking ($\beta = 2.68$, $P = 0.001$). Furthermore, the presence of a chronic disease uniquely predicted higher scores in the Exercise and Rest domain ($\beta = 0.5$, $P = 0.001$), while rural residence positively predicted Retention and Evacuation scores ($\beta = 1.20$, $P < 0.001$).

Domain-Specific Predictors: Negative Associations and Behavioral Trade-offs Conversely, several factors were independently associated with lower scores, highlighting specific life challenges. Marital status acted as a negative predictor in two distinct domains: being married was associated with lower adherence in Weather and Seasons ($\beta = -1.3$, $P = 0.001$) and significantly lower scores in Mental States ($\beta = -2.45$, $P = 0.001$).

A higher number of children presented a complex behavioral trade-off; while it increased the total lifestyle score, it independently correlated with reduced scores in Weather and Seasons ($\beta = -0.3$, $P < 0.001$) and Exercise and Rest ($\beta = -0.1$, $P = 0.020$). Regarding occupational status, compared to formal employees, being self-employed ($\beta = -0.4$, $P = 0.047$) or a homemaker ($\beta = -0.5$, $P = 0.017$) were both significant negative predictors of Exercise and Rest. Interestingly, in the Retention and Evacuation domain, having a chronic disease was associated with lower scores ($\beta = -0.51$, $P = 0.001$).

In summary, these multivariate analyses demonstrate that after rigorous model specification via LRT, gender, age, educational attainment, and family structure remain the most powerful independent determinants of lifestyle adherence in this population, with their effects varying significantly depending on the specific behavioral domain.

309 Table 4. Independent Multivariable Predictors of Total and Domain-Specific Lifestyle Scores

Outcome Variable	Predictor (Reference Category)	β	95% CI	P-value
Total Lifestyle Score	Female (Ref: Male)	4.4	1.4 to 7.5	0.004
	Rural (Ref: Urban)	1.7	-1.6 to 5.2	0.381
	Number of Children	1.6	0.6 to 2.7	0.002
Weather and Seasons	Female (Ref: Male)	0.5	-0.0 to 1.2	0.071
	Married (Ref: Single)	-1.3	-2.2 to -0.5	0.001
	Divorced (Ref: Single)	-0.7	-1.7 to 0.2	0.158
	Primary school (Ref: Illiterate)	0.0	-1.0 to 1.1	0.940
	Middle school (Ref: Illiterate)	0.9	-0.1 to 2.1	0.096
	High school diploma (Ref: Illiterate)	1.3	0.2 to 2.4	0.019
	University degree (Ref: Illiterate)	2.1	0.9 to 3.3	<0.001
	Age	0.04	0.02 to 0.06	<0.001
	Number of Children	-0.3	-0.5 to -0.1	<0.001
Exercise and Rest	Rural (Ref: Urban)	-0.2	-0.5 to 0.1	0.219
	Primary school (Ref: Illiterate)	0.3	-0.4 to 1.1	0.396
	Middle school (Ref: Illiterate)	0.6	-0.2 to 1.4	0.139
	High school diploma (Ref: Illiterate)	1.1	0.3 to 2.0	0.006
	University degree (Ref: Illiterate)	2.0	1.1 to 2.9	<0.001
	Chronic Disease (Ref: No)	0.5	0.1 to 0.8	0.001
	Self-employed (Ref: Employee)	-0.4	-0.8 to -0.0	0.047
	Homemaker (Ref: Employee)	-0.5	-0.9 to -0.0	0.017
	Other (Ref: Employee)	-0.0	-0.8 to 0.6	0.794
	Age	0.04	0.02 to 0.05	<0.001
	Number of Children	-0.1	-0.24 to -0.02	0.020
Sleep and Wakefulness	Female (Ref: Male)	0.3	0.10 to 0.62	0.005

Outcome Variable	Predictor (Reference Category)	β	95% CI	P-value
	Primary school (Ref: Illiterate)	0.3	-0.45 to 1.08	0.421
	Middle school (Ref: Illiterate)	0.3	-0.42 to 1.11	0.384
	High school diploma (Ref: Illiterate)	0.5	-0.23 to 1.27	0.179
	University degree (Ref: Illiterate)	0.8	0.07 to 1.5	0.032
	Age	0.03	0.01 to 0.04	<0.001
Eating and Drinking	Female (Ref: Male)	2.04	1.52 to 2.56	<0.001
	Primary school (Ref: Illiterate)	0.86	-0.67 to 2.39	0.271
	Middle school (Ref: Illiterate)	1.13	-0.40 to 2.67	0.149
	High school diploma (Ref: Illiterate)	1.72	0.21 to 3.23	0.025
	University degree (Ref: Illiterate)	2.68	1.16 to 4.20	0.001
	Age	0.18	0.16 to 0.21	<0.001
Retention and Evacuation	Female (Ref: Male)	0.40	0.13 to 0.67	0.003
	Rural (Ref: Urban)	1.20	0.83 to 1.58	<0.001
	Primary school (Ref: Illiterate)	0.56	-0.22 to 1.34	0.160
	Middle school (Ref: Illiterate)	0.89	0.10 to 1.68	0.027
	High school diploma (Ref: Illiterate)	0.95	0.17 to 1.73	0.016
	University degree (Ref: Illiterate)	0.68	-0.09 to 1.47	0.086
	Chronic Disease (Ref: No)	-0.51	-0.82 to -0.20	0.001
	Age	0.03	0.02 to 0.05	<0.001
Mental States	Married (Ref: Single)	-2.45	-3.92 to -0.98	0.001
	Divorced (Ref: Single)	-2.79	-5.61 to 0.031	0.012*
	Primary school (Ref: Illiterate)	-0.028	-3.37 to 3.31	0.987
	Middle school (Ref: Illiterate)	0.61	-2.68 to 3.92	0.714
	High school diploma (Ref: Illiterate)	1.43	-1.81 to 4.69	0.385

Outcome Variable	Predictor (Reference Category)	β	95% CI	P-value
	University degree (Ref: Illiterate)	2.20	-1.05 to 5.46	0.184

Note: β = Unstandardized regression coefficient; CI = Confidence Interval; Ref = Reference category. Bold values indicate statistical significance ($P < 0.05$). *Interpreted with caution as the 95% CI marginally crosses zero, suggesting potential instability in this specific estimate.

Discussion

Principal Findings and Contextualizing the Disease Burden This population-based study provides a robust baseline assessment of adherence to Traditional Iranian Medicine (TIM) lifestyle principles and its sociodemographic determinants in a large sample of adults in Mashhad. A notable clinical finding was that nearly one-third of the cohort (29.6%) reported at least one chronic non-communicable disease (NCD), with hypertension (11.7%) and musculoskeletal disorders (10.3%) being the most prevalent. This figure aligns closely with recent national estimates from Iran, where the prevalence of at least one NCD in adults has been reported to hover around 30%, reflecting the ongoing epidemiological transition in the region [10].

Farzadfar F, Yousefi M, Jafari-Khounigh A, Khorrami Z, Haghdoost A, Shadmani FK. Trend and projection of non-communicable diseases risk factors in Iran from 2001 to 2030. Scientific Reports. 2024 Apr 6;14(1):8092.

Against this backdrop, understanding the behavioral determinants of traditional lifestyle frameworks becomes highly relevant for localized public health planning.

The Central Role of Women as Health Architects Multivariable regression analysis, rigorously guided by Likelihood Ratio Tests, revealed a nuanced picture of behavioral predictors. The most consistent finding across the models was the central role of female gender. Even after adjusting for confounders, women achieved significantly higher scores in critical domains, including Eating and Drinking, Sleep and Wakefulness, and Retention and Evacuation. This robustly supports the sociological theory that in Iranian cultural contexts, women frequently function as the primary architects and managers of family health [9,11,12]. Their heightened adherence to dietary regularity and digestive health principles likely stems from both deep-seated cultural conditioning and a greater receptivity to preventive health messaging within the family unit [11–13]. From a strategic public health perspective, this finding suggests that educational interventions targeting women could yield a substantial multiplier effect, indirectly elevating the health behaviors of the entire household [14, 15].

Complex Interplays: Age, Parity, and Environmental Factors The findings regarding age and the number of children illustrate a compelling behavioral duality. Increasing age was positively associated with higher adherence across almost all domains (except Mental States). This aligns with the "weathering hypothesis" and suggests that as individuals age and increasingly encounter health stressors, they may instinctively gravitate toward traditional, preventive behavioral patterns [16, 17].

Conversely, a higher number of children presented a complex behavioral trade-off. While parity was associated with a higher total lifestyle score—potentially reflecting an overarching sense of responsibility—it was paradoxically linked to lower scores in specific domains, namely Exercise and Rest, and Weather and Seasons. This is a highly realistic finding that highlights the opportunity costs faced by parents; the logistical demands of child-rearing often cannibalize the time and cognitive bandwidth required for personal physical activity and environmental adaptation [18].

The urban-rural contrast further defies simplistic assumptions. While rural residents demonstrated superior scores in Retention and Evacuation (likely reflecting dietary patterns inherent to rural living,

such as higher fiber intake), they scored significantly lower in Exercise and Rest compared to urban dwellers. This indicates that a rural lifestyle is not inherently "healthier" across all dimensions [19]. Physical exertion in rural settings may often be incidental (e.g., agricultural labor) rather than the purposeful, structured exercise and rest protocols measured by the TIM framework.

Interpreting Distributional Skewness and the "Health-Behavior" Paradox Extending the analysis beyond central tendencies to explore data distributions revealed critical subpopulations. The left-skewed distributions and lower-tail outliers in domains like Eating and Drinking identify a vulnerable subset of individuals—likely those engaged in a fast-paced, modern urban lifestyle—with very poor adherence to traditional dietary principles. These individuals represent the primary target for acute preventive interventions [20].

Furthermore, our bivariate analysis revealed a counterintuitive finding: individuals with chronic diseases scored significantly higher in several lifestyle domains (including Exercise and Rest and Eating and Drinking) compared to healthy individuals. However, given the cross-sectional design of this study, this association must be strictly interpreted as correlational rather than causal. We cannot determine temporal precedence; it is highly plausible that this reflects "reverse causation" or a sick-role behavioral shift, wherein the diagnosis of a chronic condition acts as a behavioral catalyst, compelling patients to adopt healthier lifestyle practices [21, 22]. Thus, rather than interpreting traditional lifestyle as a protective factor that prevents disease, these findings more accurately suggest that traditional lifestyle principles are successfully utilized as a management and coping strategy by those already diagnosed with NCDs.

The Influence of Education and Occupation A particularly intriguing null finding was the lack of a significant independent effect of education level or occupation on the total lifestyle score in the final models. This suggests that adherence to these traditional principles is driven less by formal academic capital or occupational status, and more by intrinsic cultural beliefs, intergenerational knowledge transfer, and personal health status [23, 24]. This has critical implications for health policymakers: public health messages based on TIM must be culturally tailored to resonate across all socioeconomic strata, rather than exclusively targeting the highly educated elite.

Limitations: The principal limitation of this research is inherent to its cross-sectional design. Because exposure (lifestyle adherence) and outcome (chronic disease status) were measured simultaneously, we cannot establish causal inference or determine the directionality of the observed associations. As discussed, the higher lifestyle scores among chronically ill patients likely represent behavioral adaptation post-diagnosis rather than pre-morbid prevention. Furthermore, while the utilization of the SINA database and a large, randomly selected sample (N=2,522) minimizes selection bias and provides high internal validity for the Mashhad catchment area, direct generalizability to the entire Iranian population or other cultural contexts should be done with caution. Finally, lifestyle data were self-reported via telephone interviews, which may be susceptible to recall and social desirability biases, despite the rigorous training of the interviewers.

Conclusion: This large population-based study illuminates two critical realities in the Mashhad region: a substantial burden of chronic diseases (nearly 30%), and a complex, multidimensional pattern of adherence to TIM lifestyle principles. Rather than functioning as a preventive shield against disease onset, our findings suggest that TIM lifestyle principles in modern times may predominantly serve as a behavioral framework adopted by individuals—particularly women and older adults—reactively, following the onset of health challenges. The primary message for health policymakers is that indigenous knowledge systems like TIM remain highly relevant and actively practiced. Culturally adapted, evidence-based strategies that leverage these traditional frameworks—especially by empowering women as health managers—represent a pragmatic and potentially effective approach to supporting patients in the self-management of chronic diseases.

Declarations

Abbreviations TIM: Traditional Iranian Medicine; NCD: Non-communicable disease; LRT: Likelihood Ratio Test; SINA: Integrated Health Information System; CI: Confidence Interval.

Ethics approval and consent to participate

This study was approved by the Ethics Committee of Mashhad University of Medical Sciences (Ethics Code: IR.MUMS.REC.1402.073). All methods were performed in accordance with the relevant guidelines and the Declaration of Helsinki. Verbal informed consent was obtained from all individual participants included in the study prior to the telephone interview.

Consent for publication Not applicable.

Availability of data and materials: The sampling frame was derived from the SINA national database; however, the primary lifestyle and clinical data were generated de novo via telephone interviews. Because these newly collected datasets contain personally identifiable information, they are not publicly available due to ethical restrictions regarding participant confidentiality. Aggregated, de-identified data are available from the corresponding author upon reasonable request.

Conflict of Interest

All authors declare no competing interests.

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Author Contributions

N.E. Led the overall research project, developed the main conceptual framework, designed the methodology, conducted the primary data analysis, drafted the initial manuscript, coordinated revisions among co-authors, and ensured the scientific accuracy and coherence of the final version. Z.N . A. Played a central role in coordinating and supervising the data collection process, provided specialized scientific expertise throughout the study, oversaw field operations and quality-control procedures, trained and monitored interviewers to ensure methodological accuracy, contributed to refining the research instruments, and actively participated in reviewing and improving the manuscript. M. J. B Provided substantial scientific support throughout the project, contributed expert consultation during the development of the study design, participated actively in conceptual discussions and problem-solving, assisted in the interpretation and contextualization of the findings, and offered critical feedback that strengthened the analytical depth and scientific rigor of the manuscript. S. J. H. Offered supervision, provided critical feedback throughout the research process, and approved the final manuscript.

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Authors' information

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