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Effect of a Spiritual Health-Based Intervention on Spiritual Well-Being and Health-Related Risk Behaviors among Female Medical Sciences Students: A Randomized Controlled Trial

Mahshid Shad-del
Mashhad University of Medical Sciences
Naghmeh Razaghi
Mashhad University of Medical Sciences
Tahereh Sadeghi
Mashhad University of Medical Sciences
Hamidreza Zendehtalab
zendehtalabhr@mums.ac.ir

Mashhad University of Medical Sciences

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Abstract

Background

Risk-taking behaviors among university students are a growing public health concern due to their adverse consequences on physical, psychological, and social health. Spiritual health has been proposed as a potential protective factor through its influence on meaning in life, self-regulation, coping capacity, and value-based decision-making. However, evidence from randomized controlled trials regarding the effectiveness of structured spiritual health interventions in reducing risk-taking behaviors among medical sciences students remains limited.

Methods

This randomized controlled trial was conducted among 112 female undergraduate students at Mashhad University of Medical Sciences. Participants were randomly assigned to intervention (n = 56) and control (n = 56) groups using block randomization. The intervention group received a six-session structured spiritual health-based educational program (one 45-minute session per week). Outcomes were assessed at baseline and immediately after the intervention using the Paloutzian and Ellison Spiritual Well-Being Scale and the Iranian Adolescents Risk-Taking Scale (IARS). Data were analyzed using SPSS version 26, applying appropriate parametric and non-parametric tests based on data distribution. Effect sizes were calculated to evaluate the magnitude and clinical relevance of intervention effects. Cohen's d was used for continuous outcomes, with values interpreted as small (0.2), moderate (0.5), and large (≥ 0.8) effects.

Results

Baseline characteristics and study outcomes were comparable between groups. Following the intervention, spiritual health scores significantly increased in the intervention group compared with the control group (105.63 ± 10.75 vs. 90.27 ± 10.27, $P < 0.001$). The intervention group also demonstrated a significantly greater reduction in risk-taking behaviors compared with the control group (90.71 ± 5.28 vs. 108.39 ± 21.22, $P < 0.001$). The magnitude of intervention effects was large for spiritual health (Cohen's d = 1.45) and meaningful for reduction of risk-taking behaviors (Cohen's d = 1.20).

Conclusions

This trial provides evidence that a structured spiritual health-based intervention can enhance spiritual well-being and reduce risk-taking behaviors among female medical sciences students. These findings highlight the role of spiritually oriented meaning-based approaches in promoting behavioral self-regulation among university students. The findings support the integration of value-based and meaning-

oriented components into university health promotion programs as a complementary approach to traditional behavioral interventions.

Trial registration

Iranian Registry of Clinical Trials (IRCT), IRCT20250221064792N1. Registered on 19 June 2025 (https//fa.irct.ir/trial/82072).

Introduction

Risk-taking behaviors in adolescents and young adults are considered among the major challenges in contemporary public health due to their association with adverse physical, psychological, and social consequences (1). These behaviors include a wide range of actions associated with increased health risks and adverse outcomes, such as substance use, risky sexual practices, unhealthy lifestyle patterns, and aggressive behaviors (2). Evidence from university populations indicates that multiple behavioral risk domains remain prevalent among young adults, with such behaviors contributing to preventable health consequences and negatively affecting current and future health trajectories (3). Given the complexity and persistence of these behaviors, identifying vulnerable populations and effective preventive approaches within educational settings is essential (4).

Young adulthood, particularly the university period, represents a critical developmental stage characterized by increased independence, social transition, academic demands, and exposure to new environments that may influence health-related decisions (5). During this period, individuals may develop new patterns of behavior that can persist into later adulthood, making universities an important setting for preventive health interventions. Therefore, universities have emerged as critical settings for designing and implementing preventive interventions targeting health-related behaviors among young adults (6). Within this population, female medical sciences students represent a particularly relevant group because they experience the demands of young adulthood while preparing for future healthcare responsibilities in academically demanding environments (7).

Despite their academic exposure to health-related knowledge, female medical sciences students may still experience academic pressure, increased responsibilities, changing social roles, and other psychosocial challenges that increase their susceptibility to unhealthy behaviors and risk-taking patterns (8). Understanding the underlying determinants of these behaviors is therefore essential for developing targeted preventive interventions. Thus, health-related knowledge alone may not be sufficient to reduce engagement in risk-taking behaviors among female medical sciences students, highlighting the need for interventions that address underlying psychological, emotional, and meaning-related factors influencing behavioral choices (9).

Risk-taking behaviors are influenced by multiple interacting factors, including individual characteristics, psychological factors, social relationships, environmental conditions, and personal beliefs (10). Low self-

control, ineffective coping strategies, stress, and a reduced sense of meaning and purpose have been identified as contributing factors to unhealthy behavioral choices (11). These findings suggest that interventions focusing only on increasing knowledge about health risks may be insufficient, and approaches that strengthen internal psychological resources may be needed to achieve sustainable behavioral changes (12).

Among these internal resources, spiritual health has gained attention as a potential determinant of adaptive coping, self-regulation, and health-related decision-making. Spiritual health has increasingly been recognized as an important dimension of human health alongside physical, psychological, and social dimensions. Spiritual health refers to an individual's sense of meaning, purpose, inner harmony, and connection with oneself, others, nature, and a broader sense of transcendence or meaning (13). Among university students, spiritual health may represent an important internal resource for coping with academic stress and making adaptive behavioral decisions. From a health promotion perspective, spiritual health may contribute to healthier behaviors by strengthening hope, resilience, self-awareness, and self-regulatory capacity, thereby supporting adaptive coping and reducing vulnerability to maladaptive behavioral choices (14).

From a theoretical perspective, the biopsychosocial-spiritual model provides a comprehensive framework for understanding how spiritual dimensions may influence health-related behaviors. This model proposes that health outcomes emerge from the dynamic interaction of biological, psychological, social, and spiritual domains rather than from isolated behavioral determinants. Within this framework, spiritual health may influence behavioral regulation by shaping meaning systems, personal values, motivation, and coping responses. Therefore, strengthening spiritual health may represent an upstream mechanism through which individuals develop greater capacity for reflective decision-making and regulation of health-related behaviors. (15)

In addition, meaning-making and self-regulation perspectives suggest that individuals who possess stronger internalized values and a clearer sense of purpose may be better able to evaluate immediate rewards against long-term consequences, resist social pressures, and engage in adaptive behavioral choices. Accordingly, spiritual health-based interventions may operate not simply by increasing awareness, but by modifying cognitive-affective processes involved in behavioral regulation. (16)

However, available evidence suggests that spiritual health among medical sciences students may vary considerably across populations and settings (14, 16). Previous studies have reported varying levels of spiritual well-being among medical sciences students, suggesting that spiritual health represents a potentially modifiable dimension of health (17). Nevertheless, evidence specifically focusing on female medical sciences students, who may experience distinct academic and psychosocial challenges, remains insufficient to determine whether targeted interventions can effectively enhance spiritual health in this population (18).

The relationship between spirituality and health-related behaviors has been investigated in previous studies (17). Evidence indicates that higher levels of spiritual well-being are associated with healthier

lifestyles, improved psychological adaptation, and reduced engagement in harmful behaviors (15). However, evidence from randomized controlled trials and other intervention studies evaluating the effects of structured spiritual health-based programs on risk-taking behaviors among female medical sciences students remains limited. Therefore, evaluating structured spiritual health-based interventions in this population may help address an important evidence gap regarding behavioral health promotion among university students.

Based on the theoretical framework described above, the present study assumes that enhancing spiritual health may contribute to behavioral change through strengthening meaning-oriented processing, value-based decision-making, and self-regulatory capacities. Therefore, this randomized controlled trial was designed to evaluate whether a structured spiritual health-based intervention could improve spiritual well-being and reduce risk-taking behaviors among female medical sciences students (19, 20).

Methods

Study Design and Setting

This randomized controlled trial with a pretest–posttest design was conducted to evaluate the effect of a spiritual health-based intervention on risk-taking behaviors among female students at Mashhad University of Medical Sciences, Iran. The study was conducted during the 2025 academic year at the School of Nursing and Midwifery, Mashhad University of Medical Sciences. The research protocol was approved by the Ethics Committee of Mashhad University of Medical Sciences (Ethics code: IR.MUMS.NURSE.REC.1403.091). All participants provided written informed consent before enrollment. The trial was registered with the Iranian Registry of Clinical Trials (IRCT20230923059494N1) on 19 June 2025 (https://fa.irct.ir/trial/82072).

Participants and Eligibility Criteria

The target population consisted of female undergraduate students enrolled at Mashhad University of Medical Sciences. Participants were recruited through announcements distributed across the Schools of Nursing and Midwifery, Public Health, and Paramedical Sciences of Mashhad University of Medical Sciences. Participant recruitment was conducted from 23 September 2025 to 7 October 2025. Eligible students underwent initial screening based on the predefined inclusion and exclusion criteria. The inclusion criteria were being a female undergraduate student, willingness to participate in the study, ability to attend the intervention sessions, and providing written informed consent. The exclusion criteria included absence from more than two intervention sessions, participation in other psychological, spiritual, or behavioral intervention programs during the study period, development of acute physical or psychological conditions that prevented continued participation in the study, and incomplete completion of the study questionnaires. Initially, 120 students were assessed for eligibility. After evaluation of

inclusion and exclusion criteria, 112 students were enrolled and randomly assigned to the intervention and control groups.

Sample Size Calculation

The sample size was calculated based on previous evidence regarding behavioral interventions and considering a confidence level of 95%, statistical power of 80%, and expected effect size. Considering possible attrition, the final sample size was determined as 56 participants in each group (18).

No interim analyses were planned or performed, and no formal stopping guidelines were established because of the short study duration, the relatively small sample size, and the minimal-risk educational intervention.

Randomization, Allocation Concealment, and Blinding

The random allocation sequence was generated by an independent statistician using a computer-generated block randomization method. Participants were randomly assigned to the intervention or control group in a 1:1 ratio using permuted blocks of four. Allocation concealment was ensured using sequentially numbered, opaque, sealed envelopes (SNOSE), each containing the group assignment according to the randomization sequence. When an eligible participant was enrolled, the next envelope in sequence was opened, and the participant was assigned to the indicated study group.

The investigator responsible for participant enrollment did not have access to the random allocation sequence. Only the independent researcher responsible for participant assignment had access to the allocation sequence.

Because of the nature of the educational intervention, participants and the intervention provider could not be blinded. However, the outcome assessor and the data analyst remained blinded to group allocation throughout the study. Group allocation was concealed by coding the intervention and control groups as Group A and Group B until completion of the statistical analyses.

Intervention

Spiritual Health-Based Intervention Program

The spiritual health–based intervention was developed based on the concepts of spiritual health, spiritual well-being, meaning in life, personal values, self-awareness, coping strategies, and responsible decision-making. The intervention framework was developed based on the biopsychosocial-spiritual model of health and meaning-oriented approaches to behavioral regulation. According to this framework, spiritual health may influence health behaviors through enhancement of meaning-making, value clarification, coping capacity, and self-regulatory processes. Therefore, the intervention sessions were

structured to progressively address awareness of personal values, meaning in life, adaptive coping strategies, and responsible decision-making as potential pathways linking spiritual health with behavioral outcomes .

The intervention was implemented in six weekly educational sessions, each lasting approximately 45 minutes. Sessions were conducted face-to-face in group format in the classrooms of the School of Nursing. Each group consisted of 10 to 12 participants.

The intervention was delivered by a Master of Science student in Community Health Nursing who had received training in health education and spiritual health concepts. Lecture, group discussion, question-and-answer, and slide presentation methods were used to enhance active participant engagement. Before intervention delivery, the facilitator completed structured training on the theoretical foundations of spiritual health, principles of spiritually oriented health education, communication skills, and the standardized intervention protocol. The facilitator's competency was evaluated through review of the session content and supervised practice before implementation. During the intervention period, the facilitator received ongoing supervision from the research team to ensure consistency and adherence to the predefined intervention protocol.

For each session, assignments and homework tasks were designed, and participants were required to complete them between sessions. At the beginning of each session, previous assignments were reviewed and feedback was provided. In addition, brief pre- and post-session assessments were conducted to evaluate conceptual understanding and learning outcomes.

Intervention fidelity was ensured through a structured approach using a standardized, pre-designed session protocol. Fidelity was assessed using a structured checklist completed by an independent observer to ensure adherence to the predefined protocol. The control group did not receive any structured intervention during the study period and continued their routine academic activities. They were not exposed to similar educational content. Due to the presence of both groups within the same faculty, there was a potential risk of contamination between groups, which was considered a study limitation. The content of sessions is summarized in Table 1.

Table 1
Structured Description of the Spiritual Health-Based Intervention Program

Session	Main content	Teaching methods	Learning activities	Homework / assignments	In-session evaluation
1	Introduction to spiritual health, dimensions of human health, and relationship between spiritual well-being and healthy behaviors	Lecture, slide presentation, group discussion, Q&A	Guided group discussion on definition of spiritual health and personal reflection on health behaviors	Reflective writing on personal understanding of spiritual health	Brief pre- and post-session quiz on key concepts
2	Self-awareness, personal values, identity formation, and recognition of behavioral patterns	Lecture, group discussion, Q&A, slides	Values clarification exercise and structured self-reflection	Identification and written reflection on personal values and behavioral patterns	Oral questioning and feedback during discussion
3	Meaning and purpose in life and its role in motivation and health-related decision-making	Lecture, group discussion, Q&A	Motivational reflection exercise and sharing personal meaning narratives	Writing a short narrative on life meaning and health choices	Pre/post short conceptual assessment
4	Coping with stress, emotional regulation, and spiritual resources for managing life challenges	Lecture, group discussion, Q&A, slides	Stress coping scenario discussion and sharing coping experiences	Practice of a selected coping strategy and written report	Feedback on coping strategy discussion
5	Responsibility, self-control, decision-making skills, and prevention of risk-taking behaviors	Lecture, group discussion, Q&A	Role-play and decision-making scenario analysis	Completion of decision-making worksheet on real-life situations	Structured group feedback and clarification questions
6	Consolidation of concepts, goal setting, maintaining healthy behaviors, and evaluation	Group discussion, Q&A, review session	Goal-setting workshop and review of learned concepts	Development of personal health promotion plan	Final evaluation and summary assessment

The intervention group received the spiritual health-based program, while the control group received no intervention during the study period. After completion of the study, the educational content was made

available to the control group. Participants in both groups continued their routine academic activities during the trial. No additional intervention or structured educational program related to spiritual health or risk-taking behaviors was provided to either group outside the study protocol.

Data Collection Instruments

Demographic Characteristics Questionnaire

A researcher-developed questionnaire was used to collect demographic information including age, marital status, academic year, field of study, residence status, and other relevant characteristics.

Spiritual Well-Being Scale

This questionnaire was developed by Paloutzian and Ellison (1982) to assess spiritual health in two dimensions: religious well-being and existential well-being, using 20 items (10 items for each dimension). Responses are scored on a 6-point Likert scale ranging from “strongly disagree” (1) to “strongly agree” (6). The total score ranges from 20 to 120, with higher scores indicating higher levels of spiritual well-being. Some items are reverse scored. Score classification is as follows: 20–40 low, 41–99 moderate, and 100–120 high spiritual well-being (19). The reliability of the Persian version of this instrument has been reported with a Cronbach’s alpha coefficient of 0.87 (20). In the present study, the content validity of the instrument was assessed based on the opinions of seven faculty members, and its reliability was confirmed using Cronbach’s alpha coefficient in a preliminary study with 10 participants, yielding a value of 0.86.

Iranian Adolescents Risk-Taking Scale (IARS)

Risk-taking behaviors were measured using the Iranian Adolescents Risk-Taking Scale. This scale was developed by Mohammadi, Ahmadabadi, and Heidari (2011) and consists of 38 items, which are rated on a 5-point Likert scale ranging from “strongly disagree” (1) to “strongly agree” (5). The questionnaire assesses seven domains of risk-taking behaviors, including dangerous driving, aggression, smoking, substance use, alcohol consumption, sexual behaviors, and tendency toward the opposite sex. The total score ranges from 38 to 190, with higher scores indicating a greater tendency toward risk-taking behaviors. The internal consistency of the scale was excellent, with a Cronbach’s alpha coefficient of 0.93 (21). In the present study, the content validity of the instrument was evaluated by seven faculty members, and internal consistency reliability was assessed using Cronbach’s alpha coefficient in a preliminary study with 10 participants, resulting in a value of 0.91.

The selection of outcome measures was guided by the theoretical framework of the study, which considers spiritual health as the primary target of intervention and behavioral risk-taking as an important downstream health outcome. Therefore, spiritual well-being was assessed as the proximal outcome reflecting changes in the targeted spiritual domain, while risk-taking behaviors were assessed as the behavioral outcome reflecting potential changes in health-related decision patterns. Although constructs

such as meaning-making, self-regulation, and coping processes were considered as potential explanatory mechanisms, they were not directly measured in the present study and should be examined in future research.

Data Collection Procedure

Baseline measurements were collected prior to randomization in both groups. All participants completed the study questionnaires in a face-to-face setting using standardized instruments. Post-intervention measurements were conducted one day after completion of the six-week intervention, consistent with the pre-specified protocol. No follow-up assessment was performed, as the post-test coincided with the end-of-semester examination period, which could have introduced confounding effects on outcomes.

The questionnaires were administered under supervised conditions to ensure standardization of data collection. The assessors responsible for outcome measurement were not involved in the implementation of the intervention and were blinded to group allocation. Both data collection time points were defined a priori in the study protocol. There were no missing data and no participant attrition throughout the study period.

Because the intervention consisted solely of educational sessions, no serious adverse events were anticipated. Nevertheless, participants were monitored throughout the intervention for any unexpected psychological discomfort or other adverse events. Any such events would have been documented and managed according to the study protocol. No adverse events were observed during the study.

Statistical Analysis

Statistical analysis was performed using SPSS version 26. Descriptive statistics including mean, standard deviation, frequency, and percentage were used to describe participant characteristics. Normality of continuous variables was assessed using the Kolmogorov–Smirnov test. Baseline group comparability was examined using independent *t*-test, chi-square test, and Fisher's exact test where appropriate. The effect of the intervention was examined by comparing changes in outcome scores between groups. Independent *t*-tests were used to compare mean changes from baseline to post-intervention between groups. All randomized participants completed the study and were included in the final analyses according to their originally assigned groups. No missing data were observed; therefore, no imputation or other methods for handling missing data were required. Effect sizes (Cohen's *d*) were calculated to quantify the magnitude of intervention effects. A p-value < 0.05 was considered statistically significant. Because no adverse events were observed during the study, no statistical analyses of harms were performed.

No subgroup or sensitivity analyses were planned or performed. No post-hoc analyses were conducted.

Results

Of the 120 students assessed for eligibility, 112 met the inclusion criteria and were randomized into the intervention group (n = 56) and control group (n = 56). All participants completed the post-intervention assessment. A CONSORT flow diagram is presented in Fig. 1.

Baseline demographic and background characteristics of the participants are presented in Table 2. There were no statistically significant differences between the intervention and control groups regarding continuous or categorical baseline variables. Overall, the results indicate that the two groups were comparable at baseline across demographic and background characteristics, including age, GPA, parental age, family structure, academic faculty, residence status, birth order, parental education and employment status, and socioeconomic status (all $P > 0.05$).

Table 2
Baseline demographic and background characteristics of participants

Variable	Intervention (n, %) or Mean ± SD	Control (n, %) or Mean ± SD	P-value
Age (years)	23.49 ± 1.67	23.57 ± 1.63	Mann–Whitney U P = 0.535
GPA	17.08 ± 1.02	16.81 ± 1.28	Independent t-test (t = 1.28, p = 0.209)
Father's age	51.02 ± 30.6	52.75 ± 6.67	Independent t-test (t = -1.412, p = 0.161)
Mother's age	47.54 ± 5.69	48.93 ± 5.74	Independent t-test (t = -1.347, p = 0.178)
Number of family members			χ^2 = 0.160
Three persons	21 (37.5%)	23 (41.1%)	P = 0.984
Four persons	16 (28.6%)	15 (26.8%)	
Five persons	14 (25.0%)	13 (23.2%)	
Six persons	5 (8.9%)	5 (8.9%)	
Academic faculty			χ^2 = 3.625
Nursing	34 (60.7%)	24 (42.9%)	P = 0.170
Public Health	11 (19.6%)	15 (26.8%)	
Paramedical Sciences	11 (19.6%)	17 (30.4%)	
Place of residence			χ^2 = 1.039
Private residence	41 (73.2%)	36 (64.3%)	P = 0.415
Dormitory	15 (26.7%)	20 (35.7%)	
Birth order			χ^2 = 1.532
First	32 (57.1%)	37 (66.1%)	P = 0.445
Middle	20 (35.7%)	14 (25.0%)	
Last	4 (7.1%)	5 (8.9%)	
Father's education			χ^2 = 5.169
Primary	4 (7.1%)	6 (10.7%)	P = 0.078

Variable	Intervention (n, %) or Mean ± SD	Control (n, %) or Mean ± SD	P-value
Diploma	32 (57.1%)	20 (35.7%)	
Higher	20 (35.7%)	30 (53.6%)	
Mother's education			$\chi^2 = 1.877$
Primary	5 (8.9%)	2 (3.6%)	P = 0.391
Diploma	30 (53.6%)	28 (50.0%)	
Higher	21 (37.5%)	26 (46.4%)	
Father's employment status			$\chi^2 = 6.785$
Employed	56 (100%)	54 (90%)	P = 0.107
Unemployed	0 (0.0%)	2 (3.6%)	
Mother's employment status			$\chi^2 = 4.900$
Employed	56 (100%)	56 (100%)	P = 0.184
Unemployed	0 (0.0%)	0 (0.0%)	
Socioeconomic status			$\chi^2 = 2.942$
Low	4 (7.1%)	10 (17.9%)	P = 0.252
Moderate	45 (80.4%)	40 (71.4%)	
High	7 (12.5%)	6 (10.7%)	

Effect of Intervention on Spiritual Health and Risk-Taking Behaviors

Before intervention, there was no statistically significant difference between groups regarding spiritual health and risk-taking behavior scores.

After intervention, spiritual health scores significantly increased in the intervention group compared with the control group. Furthermore, risk-taking behavior scores significantly decreased among participants receiving the spiritual health-based intervention.

The effects of the intervention on the primary outcomes, including spiritual health and risk-taking behaviors, are presented in Tables 3 and 4.

Table 3
Effect of intervention on spiritual health

Outcome	Group	Baseline	Post-intervention	Mean change	Between-group difference (95% CI)	Cohen's d	P-value
Spiritual health	Intervention (n = 56)	88.93 ± 11.16	105.63 ± 10.75	+ 16.69 ± 7.94	12.02 (8.51 to 15.53)	1.45	< 0.001
	Control (n = 56)	85.59 ± 11.26	90.27 ± 10.27	+ 4.67 ± 10.62	—	0.43	—

The results presented in Table 3 indicate that the baseline values showed no statistically significant difference between the intervention and control groups in spiritual health prior to the intervention (88.93 ± 11.16 vs. 85.59 ± 11.26), confirming initial group comparability.

After the intervention, a marked improvement was observed in the intervention group compared with the control group. The post-intervention mean score of spiritual health increased to 105.63 ± 10.75 in the intervention group, whereas a smaller increase was observed in the control group (90.27 ± 10.27). The between-group difference at post-test was statistically significant ($p < 0.001$), indicating a strong intervention effect.

Analysis of change scores further confirmed these findings. The intervention group demonstrated a substantially greater improvement in spiritual health ($\Delta = +16.69 \pm 7.94$) compared with the control group ($\Delta = +4.67 \pm 10.62$), with a statistically significant between-group difference ($p < 0.001$). This indicates that the observed improvement cannot be attributed to temporal or measurement effects alone. The between-group difference in change scores was 12.02 points (95% CI: 8.51 to 15.53), indicating a statistically and clinically meaningful improvement in spiritual health following the intervention.

Effect size analysis supported the clinical relevance of these findings. The magnitude of the intervention effect was large in the intervention group (Cohen's $d = 1.45$), whereas only a small effect was observed in the control group (Cohen's $d = 0.43$). This pattern confirms that the intervention produced not only statistically significant but also clinically meaningful improvements in spiritual health.

Overall, the convergence of baseline equivalence, significant post-intervention differences, significant change-score differences, and large effect size provides robust evidence for the effectiveness of the spiritual health-based intervention.

Table 4
Effect of intervention on risk-taking behaviors

Outcome	Group	Baseline	Post-intervention	Mean change	Between-group difference (95% CI)	Cohen's d	P-value
Risk-taking behaviors	Intervention (n = 56)	114.86 ± 7.66	90.71 ± 5.28	−24.15 ± 7.66	−15.34 (−18.05 to −12.63)	1.20	< 0.001
	Control (n = 56)	117.20 ± 6.80	108.39 ± 21.22	−8.81 ± 6.80	—	0.30	—

The results presented in Table 4 indicate that baseline scores of risk-taking behaviors were comparable between the intervention and control groups, with no meaningful differences observed prior to the intervention (114.86 ± 7.66 vs. 117.20 ± 6.80), confirming baseline equivalence.

After the intervention, a pronounced reduction in risk-taking behaviors was observed in the intervention group compared with the control group. The post-intervention mean score decreased to 90.71 ± 5.28 in the intervention group, whereas a smaller reduction was observed in the control group (108.39 ± 21.22), with a statistically significant between-group difference ($p < 0.001$), indicating a strong intervention effect.

Analysis of change scores further supported these findings. The intervention group demonstrated a substantially greater reduction in risk-taking behaviors ($\Delta = -24.15 \pm 7.66$) compared with the control group ($\Delta = -8.81 \pm 6.80$), confirming that the observed improvement was not attributable to temporal effects or random variation. The between-group difference in change scores was − 15.34 points (95% CI: −18.05 to − 12.63), demonstrating a significant reduction in risk-taking behaviors in the intervention group compared with the control group.

Effect size estimates reported in Table 4 indicate a large intervention effect in the intervention group (Cohen's d = 1.20), whereas only a small effect was observed in the control group (Cohen's d = 0.30). This pattern demonstrates that the intervention had both statistically significant and clinically meaningful effects in reducing risk-taking behaviors.

Overall, the convergence of baseline comparability, significant post-intervention differences, significant change scores, and effect size estimates provides robust evidence for the effectiveness of the intervention in reducing risk-taking behaviors.

No adverse events or unintended events related to the intervention were reported in either the intervention or control group during the study period.

No subgroup or sensitivity analyses were performed beyond the prespecified primary analyses.

Discussion

This randomized controlled trial evaluated the effectiveness of a structured spiritual health-based intervention on spiritual well-being and risk-taking behaviors among female medical sciences students. The findings demonstrated that the intervention produced a statistically and clinically meaningful improvement in spiritual health alongside a significant reduction in risk-taking behaviors compared with the control group. The magnitude of change, supported by large effect sizes, indicates that the observed differences are not only statistically significant but also behaviorally relevant.

Previous studies among university students have mainly reported associations between spiritual well-being and healthier behaviors. For example, observational studies have shown that higher spiritual well-being is related to lower health-risk behaviors; however, unlike the present trial, these studies could not determine whether improving spiritual health leads to behavioral change (9). The present study extends previous observational evidence by providing experimental findings from a randomized controlled design. While earlier studies primarily identified spiritual health as an associated factor related to healthier behavioral patterns, the current findings suggest that spiritual health may also represent a modifiable target for intervention. This distinction is important because it shifts the role of spirituality from a passive protective characteristic toward an actionable component of university-based health promotion strategies.

The observed behavioral changes can be interpreted within an integrated self-regulation and meaning-making framework. Spiritual health may function as a higher-order cognitive-affective system that shapes value hierarchies, enhances reflective processing, and strengthens inhibitory control in situations involving immediate rewards or social pressure (16). Although the observed reduction in risk-taking behaviors is theoretically consistent with enhanced self-regulation and meaning-oriented processes, these mechanisms were not directly measured in the present study. Therefore, the proposed pathway should be interpreted as a theoretical explanation rather than a confirmed mediational mechanism. Future studies incorporating measures of self-regulation, coping, and meaning in life are needed to empirically examine these pathways.

From this perspective, risk-taking behavior is not solely a function of knowledge deficit, but is also influenced by internalized meaning structures and value-based self-regulation mechanisms (9). The intervention likely acted by strengthening these internal regulatory processes, thereby shifting decision-making patterns toward lower-risk behavioral choices (12).

The findings are broadly consistent with the literature indicating that spiritual well-being is inversely associated with engagement in health-compromising behaviors and positively associated with adaptive coping strategies (9, 16). However, previous studies have largely been correlational in nature, limiting causal inference (25). The present randomized design extends this evidence by demonstrating that targeted enhancement of spiritual health can produce measurable changes in behavioral outcomes. This strengthens the argument that spiritual health is not merely a stable dispositional trait, but a modifiable construct responsive to structured educational interventions (17).

In terms of theoretical positioning, the results support a biopsychosocial-spiritual model of health behavior (15). Conventional health behavior interventions typically emphasize cognitive components such as risk perception and knowledge acquisition. While these factors are necessary, they may be insufficient for sustained behavioral change (26). The current findings suggest that incorporating spiritual and value-based dimensions may provide an additional pathway for behavioral regulation by influencing motivational depth, self-concept integration, and long-term goal alignment.

Importantly, the intervention demonstrated differential effects on both outcomes, with a stronger magnitude of change observed for spiritual health than for risk-taking behaviors. This pattern suggests a potential sequential pathway in which enhancement of spiritual well-being serves as an upstream mechanism that subsequently influences behavioral outcomes. However, the cross-sectional measurement structure of post-intervention outcomes limits formal mediation testing in the present study (27).

From a contextual perspective, the reduction in risk-taking behaviors among medical sciences students is particularly relevant given their dual role as both health system trainees and future health behavior influencers (5). Behavioral patterns established during this developmental period may extend into professional practice, potentially shaping future patient counseling and health promotion practices (16). Nevertheless, caution is required in extrapolating long-term professional implications, as the present study did not include follow-up assessment.

Unlike many prior studies that have examined spirituality and health behavior associations using cross-sectional designs, the present study provides experimental evidence supporting a causal pathway (28). Studies in university populations have generally reported that higher spiritual well-being is associated with lower engagement in risky behaviors and better psychological adjustment (29). The present findings are consistent with these observations but extend them by demonstrating that structured intervention can actively modify both spiritual health and behavioral outcomes within a relatively short time frame. This strengthens the argument for incorporating spiritual health components into university-based health promotion strategies (16).

Implications for practice

The findings suggest that spiritual health-based programs may be integrated into university health promotion services as complementary interventions alongside psychological and behavioral strategies. Such interventions may be particularly relevant in student populations exposed to academic stress, identity exploration, and transitional life challenges. Implementation, however, should remain non-denominational and culturally inclusive, focusing on universal constructs such as meaning, values, and adaptive coping rather than religious doctrine.

Strengths and limitations (strengthened critical framing)

The study benefits from a randomized controlled design, inclusion of a control group, standardized intervention delivery, and use of validated measurement tools, which collectively enhance internal validity.

Nevertheless, several limitations should be considered when interpreting the findings. First, although participants were recruited from three different academic schools (Nursing and Midwifery, Public Health, and Paramedical Sciences), the study was conducted within a single university and included only female medical sciences students. Therefore, the generalizability of the findings to male students, students from other universities, and different educational or cultural contexts may be limited. Multi-center studies involving more diverse student populations are needed to determine the broader applicability of the intervention.

Second, although randomization and allocation concealment were implemented, participants from the intervention and control groups were recruited from the same academic environment. Therefore, potential contamination between groups cannot be completely excluded, as participants may have exchanged information related to the intervention content, which could have influenced the observed differences.

Third, outcomes were assessed immediately after completion of the intervention, and no long-term follow-up assessment was performed. Consequently, the durability of improvements in spiritual health and reduction in risk-taking behaviors remains uncertain, and future studies should evaluate whether these effects are maintained over extended periods.

Fourth, both outcome measures were based on self-reported questionnaires. Although validated instruments were used, responses related to spirituality and risk-taking behaviors may be influenced by social desirability bias, particularly in a student population with academic exposure to health-related concepts. Future research may benefit from incorporating objective indicators or multiple assessment approaches.

Finally, although the intervention was theoretically developed to influence meaning-making, coping, and self-regulatory processes, these potential mechanisms were not directly measured. Therefore, causal interpretation of the pathways underlying behavioral changes should be made cautiously. Future studies should include mediator variables and apply appropriate analytical approaches to clarify how spiritual health interventions produce behavioral effects.

Future directions

Future research should incorporate longitudinal designs to evaluate the durability of intervention effects, employ multi-center sampling to improve generalizability, and examine mediating pathways such as resilience, self-efficacy, and emotion regulation. Advanced analytical approaches such as structural equation modeling may further clarify the causal pathways linking spiritual health to behavioral outcomes.

Conclusion

This trial provides evidence that a structured spiritual health-based intervention can enhance spiritual well-being and reduce risk-taking behaviors among female medical sciences students. The findings support the integration of value-based and meaning-oriented components into university health promotion programs as a complementary approach to traditional behavioral interventions.

Declarations

Ethical approval and consent to participate

This study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki. Ethical approval was obtained from the Ethics Committee of Mashhad University of Medical Sciences. (Approval No: IR.MUMS.NURSE.REC.1403.091). All participants were informed about the objectives and procedures of the study, and written informed consent was obtained from all participants prior to their participation. Participation was voluntary, and participants were assured of the confidentiality and anonymity of their information. The trial was registered with the Iranian Registry of Clinical Trials (IRCT20230923059494N1) on 19 June 2025 (https://fa.irct.ir/trial/82072).

Consent for Publication

Not applicable.

Competing Interests

The authors declare that they have no competing interests.

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Author Contribution

HZ contributed to study supervision, methodology, critical revision, and final approval of the manuscript.MS contributed to study design, data collection, intervention implementation, and manuscript preparation.NR and TS contributed to data collection, analysis, and manuscript revision.All authors read and approved the final manuscript.

Data Availability

This statement reflects the final version approved by all authors and supersedes any version previously included in the manuscript.

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Figures

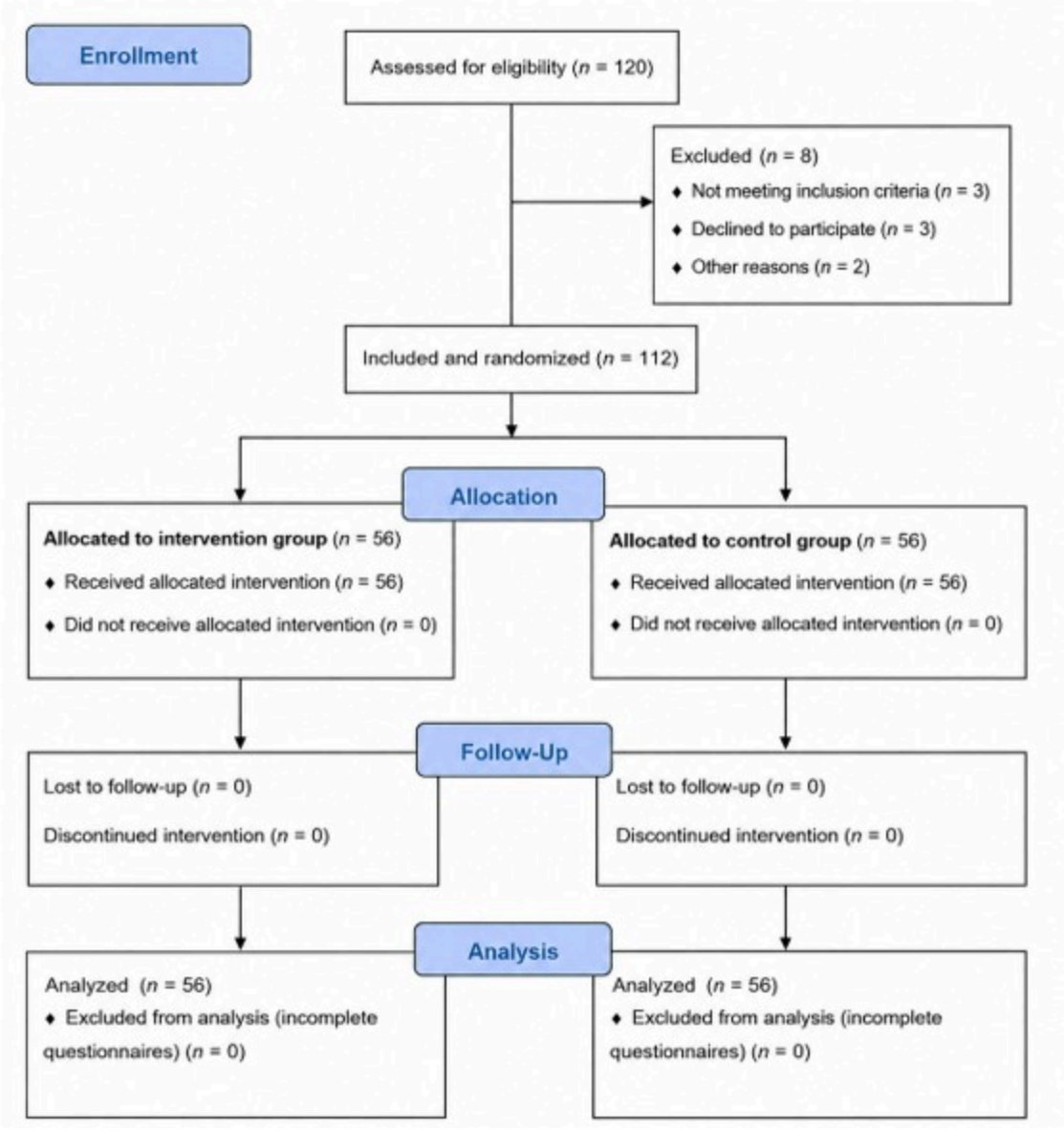


Figure 1

CONSORT flow diagram of participant enrollment in the study

Supplementary Files

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- CONSORT2025checklist.docx
- Appendix1.docx
- Appendix2EnglishInformedConsentForm.docx
- Appendix3PersianInformedConsentForm.docx
- StudyProtocol.docx