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Knowledge, attitudes, and practices regarding metabolic associated fatty liver disease (MAFLD) in elderly patients

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This study investigates the knowledge, attitudes, and practices (KAP) of elderly patients with metabolic associated fatty liver disease (MAFLD). A cross-sectional study was conducted from August to October 2024, involving 404 patients in the Geriatrics Department of Shanghai Sixth People's Hospital. Participants provided demographic information and completed a structured questionnaire to assess KAP scores. A score of ≥ 70% was considered good for knowledge, attitudes, and practices. Structural equation modeling (SEM) was employed to analyze direct and indirect relationships among the KAP dimensions and identify the pathways through which knowledge and attitudes influence practices. The average age of participants was 72.43 ± 7.88 years. Knowledge, attitude, and practice scores were 13.47 ± 5.40, 28.68 ± 5.04, and 28.01 ± 4.61, respectively. SEM findings indicated that knowledge significantly influenced practice (β = 0.39, *P* < 0.001), and attitudes also notably impacted practice (β = 0.34, *P* < 0.001), though knowledge's indirect influence through attitudes was not significant (β = 0.03, *P* = 0.363). Overall, these findings highlight inadequate KAP among elderly patients with MAFLD, exemplified by 75.2% being unfamiliar of MAFLD's progression to cirrhosis or cancer, underscoring the need for targeted educational initiatives to improve self-management and health outcomes.

Keywords Metabolic-Associated fatty liver disease, Knowledge, attitudes, practice, Elderly, Cross-Sectional study, Health education

Background

"Metabolic-associated fatty liver disease (MAFLD; formerly known as nonalcoholic fatty liver disease [NAFLD]) is a condition estimated to affect approximately one-fourth of the global population, representing a significant public health burden. This nomenclature shift reflects a redefinition emphasizing metabolic dysfunction as a key diagnostic criterion, moving away from exclusionary terms such as 'nonalcoholic'[1]. Globally, pooled prevalence rates for MAFLD are reported as 38.8%[2,3]. Within China, a systematic review and meta-analysis estimated the prevalence of MAFLD to be 29.81% (27.78–31.93%), with projections suggesting that approximately 314.58 million individuals will be diagnosed with MAFLD by 2030[4,5]. This growing burden is alarming, particularly as MAFLD progression can result in severe complications such as cirrhosis, hepatocellular carcinoma, and cardiovascular diseases[1].

Epidemiological evidence indicates that the prevalence of MAFLD exhibits a marked age-dependent pattern, with peak rates observed in males aged 40–50 years and females aged 60–69 years[6]. Elderly individuals with MAFLD bear a significantly higher burden of risk factors, including hypertension, diabetes mellitus, hyperlipidemia, and obesity, which exacerbate disease progression[7]. Moreover, advanced age is associated with more severe clinical manifestations of MAFLD, such as pronounced hepatic fibrosis and elevated levels of liver dysfunction[8]. These findings are supported by data demonstrating higher levels of liver-related serum markers and more severe histopathological changes in older patients[7,9]. Moreover, the prognosis for elderly patients with MAFLD is particularly poor, with a significant proportion progressing to irreversible cirrhosis and hepatocellular carcinoma if the disease is not effectively managed[10]. Self-management plays a crucial role in MAFLD treatment,

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as evidence suggests that adherence to lifestyle modifications, including dietary adjustments and regular physical activity, can significantly delay disease progression and improve clinical outcomes[11]. Interventions targeting self-management behaviors are therefore essential to mitigating the long-term complications of MAFLD in elderly populations.

The Knowledge-Attitude-Practice (KAP) model is a widely recognized framework for understanding and influencing health-related behaviors[12]. The KAP questionnaire, often utilized in conjunction with this model, enables a comprehensive assessment of the knowledge, attitudes, and practices of target populations within the healthcare domain, thereby identifying gaps in awareness and levels of acceptance toward specific health interventions[13]. This model is grounded in the principle that knowledge positively influences attitudes, which in turn shape practices, thus serving as an essential component of health literacy and behavioral change[14].

Previous studies on MAFLD have primarily focused on younger populations[15] or employed qualitative methodologies[16]. Despite the substantial burden of MAFLD among elderly individuals, there is a notable paucity of research exploring their knowledge, attitudes, and practices concerning the disease. This study aims to investigate the KAP status of elderly patients with MAFLD.

Methods

Study design and participants

A cross-sectional study was conducted between August and October 2024 in the Geriatrics Department of Shanghai Sixth People's Hospital, targeting elderly patients with MAFLD. Ethical approval for the study was granted by the Medical Ethics Committee of Shanghai Sixth People's Hospital (Approval Number: 2024 – 153). Participants were recruited consecutively from the outpatient department to minimize selection bias. All participants were informed that participation was voluntary, and anonymity was guaranteed to reduce response bias. Prior to participation, informed consent was obtained from all individuals in accordance with ethical guidelines.

The inclusion criteria were as follows: (1) diagnosis of MAFLD[17]; (2) aged 60 years or older; (3) cognitively able to understand the study objectives; and (4) willingness to provide written informed consent. The exclusion criteria included patients with severe comorbidities, such as advanced cancer or serious cardiopulmonary diseases, which could significantly impair their ability to participate in the study.

Questionnaire

The development of the questionnaire was informed by a thorough review of relevant literatures[15,16] and established guidelines, including the Guidelines for the prevention and treatment of metabolic dysfunction-associated (non-alcoholic) fatty liver disease(Version 2024)[17] and the AASLD Practice Guidance on the Clinical Assessment and Management of Nonalcoholic Fatty Liver Disease[18]. After drafting the initial version of the questionnaire, two senior experts from the Geriatrics Department in our hospital, each with over 15 years of experience in MAFLD diagnosis and management, conducted a thorough review. They evaluated the questionnaire based on clinical relevance, clarity, and redundancy, refining the items by removing overlapping questions and simplifying technical terminology to enhance content validity. In case of disagreement, consensus was achieved through iterative discussion until full agreement was reached. Following the initial drafting phase, a pilot study with 29 participants was subsequently conducted, during which the reliability of the questionnaire was assessed. The Cronbach's α coefficient for the entire instrument was 0.9318, demonstrating excellent internal consistency. Subscale reliability was similarly robust, with coefficients of 0.9273 for the knowledge section, 0.8816 for the attitude section, and 0.9104 for the practice section. Furthermore, during the pilot study, participants were invited to identify any unclear or confusing items. No concerns were reported, indicating that the questionnaire was well understood, thereby supporting its face validity. These validation steps collectively improve the reliability of our assessment tool and enhance the robustness of our study findings.

The finalized questionnaire, administered in Chinese, consisted of four sections: demographic information, knowledge, attitudes, and practices (Additional file. Questionnaire). The demographic section collected data such as age, gender, education level, marital status, monthly income, height, weight, and the history and severity of MAFLD. The Knowledge section included 11 items, with responses scored as follows: "very familiar" (2 points), "heard of it" (1 point), and "unclear" (0 points), resulting in a total score range of 0 to 22. The Attitude section comprised 9 items evaluated on a five-point Likert scale, with options ranging from "strongly agree" (5 points) to "strongly disagree" (1 point), yielding a possible score range of 9 to 45. The Practice section contained 9 items, of which the first 8 were also rated on a Likert scale from "never" (1 point) to "always" (5 points), producing a total score range of 8 to 40. The ninth item explored the sources of the participants' knowledge about MAFLD, analyzed descriptively to identify trends in information acquisition. A scoring threshold of ≥ 70.0% of the maximum score was established to classify participants as having good knowledge, positive attitudes, and proactive practices[19].

Questionnaire distribution and quality control

This study employed a mixed-method approach to questionnaire distribution, integrating both online and offline modalities to maximize participant accessibility and response rates. Paper-based questionnaires were administered in person at the Geriatrics Department outpatient clinic, allowing direct engagement with participants. In parallel, an online questionnaire was created using the Sojump website (https://www.wjx.cn/), and a QR code was generated for data collection via WeChat. The electronic questionnaires could be scanned on-site, providing a convenient digital option for respondents. Offline responses were collected promptly by attending physicians, ensuring minimal data loss and maintaining participant confidentiality. Subsequently, all

paper-based responses were systematically entered into a centralized database for analysis, ensuring consistency across data collection methods.

To ensure data reliability and validity to study criteria, we implemented a comprehensive quality control protocol for questionnaire screening. This included setting a minimum completion time threshold (≥90 s) based on based on the questionnaire's length (45 items at ~2 s per item). Responses below this threshold were excluded to ensure data quality. Besides, a common-sense trap question was incorporated to identify and exclude inattentive participants: "The capital of China is Shanghai." Questionnaires with incorrect responses to this question were deemed invalid and excluded from the analysis.

Sample size

The sample size was calculated based on the formula for cross-sectional studies[20]:$n = Z^2 \times P \times (1 - P) / d^2$, Where Z is the standard normal variate (1.96 for a 95% confidence level), P is the expected prevalence of MAFLD knowledge among elderly patients (estimated at 50% due to lack of prior data), and d is the margin of error (set at 5%). The minimum required sample size was calculated to be 384 participants. To account for potential non-response or incomplete data, we increased the sample size by 5%, resulting in a target of 404 participants.

Statistical methods

Statistical analyses were performed using STATA 17.0 (StataCorp, College Station, TX, USA). Continuous data were assessed for normality using appropriate statistical tests. For normally distributed data, results were expressed as means and standard deviations (SD), with group comparisons conducted using independent samples t-tests for two groups or one-way analysis of variance (ANOVA) for three or more groups. In cases where continuous data were not normally distributed, medians along with interquartile ranges (IQR; 25th and 75th percentiles) were reported, and group comparisons were performed using the Wilcoxon-Mann-Whitney test for two groups or the Kruskal-Wallis test for multiple groups. Correlations between the dimensions of knowledge, attitude, and practice were examined using Spearman's rank correlation coefficients. To explore the mediating effect of attitudes on the relationship between knowledge and practices, structural equation modeling (SEM) was employed. Model fit was evaluated based on established thresholds, including a root mean square error of approximation (RMSEA) and standardized root mean residual (SRMR) less than 0.08, a Tucker-Lewis index (TLI) greater than 0.80, and a comparative fit index (CFI) exceeding 0.80. Both direct and indirect effects were estimated and compared within the SEM framework to elucidate the pathways of influence among KAP dimensions. All statistical tests were two-tailed, and a P-value of less than 0.05 was considered indicative of statistical significance.

Results

Basic information on the population

A total of 407 questionnaires were collected. After excluding 2 responses with a completion time of <90 s and 1 with incorrect answers to the trap question, 404 valid responses were retained. Of these, 203 (50.25%) were male, with mean age of 72.43 ± 7.876 years, mean BMI of 24.77 ± 2.32 kg/m^2, 138 (34.16%) had high school/technical school education, 164 (40.59%) had monthly household income per person of 10,000–20,000 Yuan, 156 (38.61%) had been diagnosed with fatty liver for 5–10 years, 328 (81.19%) had simple fatty liver, 356 (88.12%) had comorbidities, and only 49 (12.13%) had received education promotion about MAFLD (Table 1).

The mean knowledge, attitude, and practice scores were 13.47 ± 5.40 (possible range: 0–22), 28.68 ± 5.04 (possible range: 9–45), and 28.01 ± 4.61 (possible range: 8–40), respectively. Participants' knowledge, attitude, and practice scores varied across age, monthly household income per person, first diagnosed with MAFLD, and education promotion about MAFLD (all $P < 0.005$). Meanwhile, differences in knowledge scores were more likely to be found among participants with different education ($P = 0.039$), BMI ($P = 0.020$), and comorbidities ($P = 0.042$). Differences in attitude scores were more likely to be found among those with different BMI ($P < 0.001$) and comorbidities ($P < 0.001$). Differences in practice scores were more likely to be found among those with different gender ($P = 0.002$), education ($P < 0.001$), and marital status ($P = 0.010$) (Table 1).

Knowledge, attitude, and practice

The distribution of knowledge dimensions showed that the three questions with the highest number of participants choosing the 'Not clear' option were 'Common symptoms of MAFLD include fatigue, abdominal discomfort, and hepatomegaly.' (K4) with 43.56%, indicating nearly half of participants lacked awareness of symptom recognition—a critical gap for early self-identification of disease exacerbation, 'MAFLD may progress to liver cirrhosis and even liver cancer.' (K5) with 29.95%, highlighting that nearly one-third underestimated the life-threatening complications of MAFLD, and 'The prevalence of MAFLD is higher among the elderly population.' (K2) with 28.96% (Table 2).

Responses to the attitude dimension showed that only 4.21% strongly agreed and 11.14% agreed that MAFLD is a serious health issue (A1), 4.46% strongly agreed and 9.65% agreed that MAFLD affects their quality of life (A2), and 3.71% strongly agreed and 13.37% agreed that concerned that MAFLD may progress to liver cirrhosis or liver cancer (A8) (Table 3).

Responses to the practice dimension showed that 37.62% rarely and 7.92% never engage in regular physical exercise (P4), 25.25% rarely and 1.49% never monitor and record changes in their weight or waist circumference (P5), 21.53% rarely and 1.24% never monitor metabolic indicators such as blood glucose and lipids (P8) (Table 4).

N = 404	N (%)	Knowledge score		Attitude score		Practice score	
		Mean ± SD	P	Mean ± SD	P	Mean ± SD	P
Total score		13.47 ± 5.40		28.68 ± 5.04		28.01 ± 4.61	
Gender			0.525		0.310		**0.002**
Male	203(50.25)	13.66 ± 5.24		28.68 ± 5.43		27.30 ± 4.64	
Female	201(49.75)	13.27 ± 5.56		28.66 ± 4.62		28.72 ± 4.47	
Age (years old)	72.43 ± 7.876		**0.003**		**0.009**		**< 0.001**
60 ~ 69	145(35.89)	13.13 ± 5.32		30.26 ± 6.38		29.46 ± 5.38	
70 ~ 79	175(43.32)	14.46 ± 5.19		27.84 ± 3.69		27.36 ± 3.89	
≥ 80	84(20.79)	11.97 ± 5.59		27.66 ± 4.12		26.85 ± 3.89	
Education			**0.039**		0.852		**< 0.001**
Junior high school or below	111(27.48)	12.40 ± 5.45		28.35 ± 4.19		26.83 ± 3.95	
High school/technical school	138(34.16)	13.42 ± 5.53		28.57 ± 4.96		27.32 ± 4.31	
Associate degree and bachelor's degree	48(11.88)	15.04 ± 5.29		28.31 ± 5.16		28.85 ± 4.65	
Master's degree or above	107(26.49)	13.93 ± 5.05		29.30 ± 5.84		29.73 ± 5.05	
Marital status			0.304		0.557		**0.010**
Single/divorced/widowed	65(16.09)	12.86 ± 5.46		28.2 ± 4.72		26.83 ± 4.12	
Married	339(83.91)	13.58 ± 5.39		28.76 ± 5.10		28.23 ± 4.67	
Monthly household income per person			**< 0.001**		**< 0.001**		**0.007**
< 10,000	92(22.77)	11.21 ± 5.52		31.29 ± 5.82		28.14 ± 5.14	
d.10,000–20,000	164(40.59)	13.71 ± 4.96		28.17 ± 4.65		27.26 ± 4.50	
e.>20,000	148(36.63)	14.60 ± 5.41		27.60 ± 4.35		28.75 ± 4.27	
First diagnosed with MAFLD			**0.046**		**< 0.001**		**0.008**
Within 1 year	30(7.43)	11.56 ± 5.46		34.46 ± 6.76		31 ± 5.50	
2–5 years	142(35.15)	12.97 ± 5.36		28.44 ± 4.80		28.02 ± 4.42	
5–10 years	156(38.61)	13.94 ± 5.24		27.79 ± 3.87		27.30 ± 4.21	
10–20 years	61(15.1)	13.65 ± 5.61		28.88 ± 5.49		27.86 ± 5.15	
Over 20 years	15(3.71)	16.4 ± 5.31		27.6 ± 5.17		29.8 ± 3.72	
Current stage of MAFLD			0.717		0.064		0.644
Simple fatty liver	328(81.19)	13.48 ± 5.46		28.66 ± 5.00		28.11 ± 4.68	
Advanced fatty liver	49(12.13)	13.16 ± 4.91		27.85 ± 4.56		27.26 ± 4.59	
Unclear	27(6.68)	13.92 ± 5.62		30.29 ± 5.99		28.11 ± 3.64	
BMI	24.77 ± 2.32		**0.002**		**< 0.001**		0.290
≤ 23.9	151(37.38)	14.67 ± 5.39		29.76 ± 5.08		28.50 ± 5.00	
24.0-27.9	218(53.96)	12.91 ± 5.43		27.82 ± 4.55		27.59 ± 4.11	
≥ 28.0	35(8.66)	11.77 ± 4.21		29.28 ± 6.67		28.51 ± 5.60	
Comorbidities			**0.042**		**< 0.001**		0.816
None of above	48(11.88)	11.79 ± 5.40		32.25 ± 6.86		28.54 ± 6.11	
Comorbidities(diabetes、coronary heart disease、hyperlipidemia、hypertension and other chronic diseases)	356(88.12)	13.69 ± 5.37		28.19 ± 4.54		27.94 ± 4.37	
Education promotion about MAFLD			**0.004**		**< 0.001**		**< 0.001**
Yes	49(12.13)	15.46 ± 4.49		33.73 ± 6.30		32.02 ± 5.43	
No	355(87.87)	13.19 ± 5.46		27.97 ± 4.41		27.45 ± 4.20	

Table 1. Basic information and KAP scores of patients.

Correlations between KAP

Further correlation analysis revealed positive correlations between knowledge scores and attitude scores ($r = 0.2271$, $P < 0.001$), as well as between knowledge scores and practice scores ($r = 0.1955$, $P < 0.001$). Additionally, attitude scores were positively correlated with practice scores ($r = 0.2454$, $P < 0.001$) (Table 5).

Structural equation model

The fit of the SEM model yielded good indices demonstrating good model fit (RMSEA value: 0.068, SRMR value: 0.110, TLI value: 0.877, and CFI value: 0.895) (**Table** S1), although the SRMR value slightly exceeded the recommended threshold of 0.08, the RMSEA (< 0.08) and incremental fit indices (TLI/CFI > 0.80) collectively supported acceptable model fit. The results show that knowledge had direct effects on practice ($\beta = 0.39$, $P < 0.001$), as well as attitude had a direct impact on practice ($\beta = 0.34$, $P < 0.001$) (**Table S2 and** Fig. 1). Additionally, knowledge indirectly influenced practice through attitude, with an indirect effect of $\beta = 0.03$ ($P = 0.363$), highlighting the mediating role of attitude in the relationship between knowledge and practice.

Items, *n* (%)	Very familiar	Heard of it	Unclear
1. **Metabolic associated fatty liver disease (MAFLD) refers to a chronic liver condition caused by genetic predisposition, nutritional excess, and insulin resistance.**	145(35.89)	210(51.98)	49(12.13)
2. **The prevalence of MAFLD is higher among the elderly population.**	120(29.7)	167(41.34)	117(28.96)
3. **Major risk factors for MAFLD include obesity, type 2 diabetes, sarcopenia, and metabolic syndrome.**	133(32.92)	228(56.44)	43(10.64)
4. **Common symptoms of MAFLD include fatigue, abdominal discomfort, and hepatomegaly.**	73(18.07)	155(38.37)	176(43.56)
5. **MAFLD may progress to liver cirrhosis and even liver cancer.**	100(24.75)	183(45.3)	121(29.95)
6. **Patients with MAFLD are also at increased risk for cardiovascular, renal, and metabolic-related diseases.**	190(47.03)	195(48.27)	19(4.7)
7. **MAFLD patients should undergo regular follow-ups to monitor liver fibrosis progression.**	132(32.67)	171(42.33)	101(25)
8. **Treatment options for MAFLD include lifestyle modifications, medication, and surgery.**	140(34.65)	223(55.2)	41(10.15)
9. **A healthy diet and regular exercise can slow or even reverse the progression of MAFLD.**	214(52.97)	183(45.3)	7(1.73)
10. **Reducing high-fat and high-sugar foods helps manage MAFLD.**	217(53.71)	183(45.3)	4(0.99)
11. **Regular exercise helps reduce liver fat and improve liver function.**	223(55.2)	171(42.33)	10(2.48)

Table 2. Knowledge dimension distribution.

Items, *n* (%)	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
1. **I believe MAFLD is a serious health issue.**	17(4.21)	45(11.14)	102(25.25)	155(38.37)	85(21.04)
2. **I believe MAFLD affects my quality of life.**	18(4.46)	39(9.65)	75(18.56)	165(40.84)	107(26.49)
3. **I think regular check-ups are necessary for patients with MAFLD.**	54(13.37)	128(31.68)	190(47.03)	28(6.93)	4(0.99)
4. **I am confident in the treatment outcomes of MAFLD.**	17(4.21)	59(14.6)	302(74.75)	22(5.45)	4(0.99)
5. **I am willing to follow the doctor's advice for disease management.**	119(29.46)	239(59.16)	43(10.64)	3(0.74)	/
6. **I am willing to make dietary and exercise adjustments to manage the progression of MAFLD.**	157(38.86)	207(51.24)	38(9.41)	1(0.25)	1(0.25)
7. **I believe traditional Chinese medicine is effective in managing MAFLD.**	48(11.88)	95(23.51)	123(30.45)	101(25)	37(9.16)
8. **I am concerned that MAFLD may progress to liver cirrhosis or liver cancer.**	15(3.71)	54(13.37)	180(44.55)	139(34.41)	16(3.96)
9. **I am willing to participate in health education and training related to MAFLD.**	32(7.92)	107(26.49)	142(35.15)	118(29.21)	5(1.24)

Table 3. Attitude dimension distribution.

Items, *n* (%)	Always	Often	Sometimes	Rarely	Never
1. **I regularly undergo medical check-ups to monitor disease progression.**	33(8.17)	105(25.99)	191(47.28)	68(16.83)	7(1.73)
2. **I take medications as prescribed by my doctor.**	125(30.94)	197(48.76)	55(13.61)	21(5.2)	6(1.49)
3. **I follow the doctor's dietary recommendations.**	72(17.82)	209(51.73)	106(26.24)	16(3.96)	1(0.25)
4. **I engage in regular physical exercise.**	47(11.63)	66(16.34)	107(26.49)	152(37.62)	32(7.92)
5. **I monitor and record changes in my weight or waist circumference.**	28(6.93)	72(17.82)	196(48.51)	102(25.25)	6(1.49)
6. **I try to avoid alcohol consumption.**	226(55.94)	79(19.55)	79(19.55)	14(3.47)	6(1.49)
7. **I pay attention to the intake of fat and sugar in my diet.**	48(11.88)	197(48.76)	136(33.66)	21(5.2)	2(0.5)
8. **I regularly monitor metabolic indicators such as blood glucose and lipids.**	33(8.17)	83(20.54)	196(48.51)	87(21.53)	5(1.24)

Table 4. Practice dimension distribution.

	Knowledge	Attitude	Practice
Knowledge	1		
Attitude	0.2271 (P<0.001)	1	
Practice	0.1955 (P<0.001)	0.2454 (P<0.001)	1

Table 5. Correlation analysis.

Discussion

Elderly patients with MAFLD demonstrated insufficient knowledge, unfavorable attitudes, and limited proactive practices toward disease management, highlighting a significant gap in their understanding and engagement with self-care practices. These findings underscore the urgent need for targeted educational interventions and structured health promotion programs aimed at enhancing knowledge, fostering positive attitudes, and encouraging evidence-based practices among elderly patients to improve disease outcomes and quality of life.

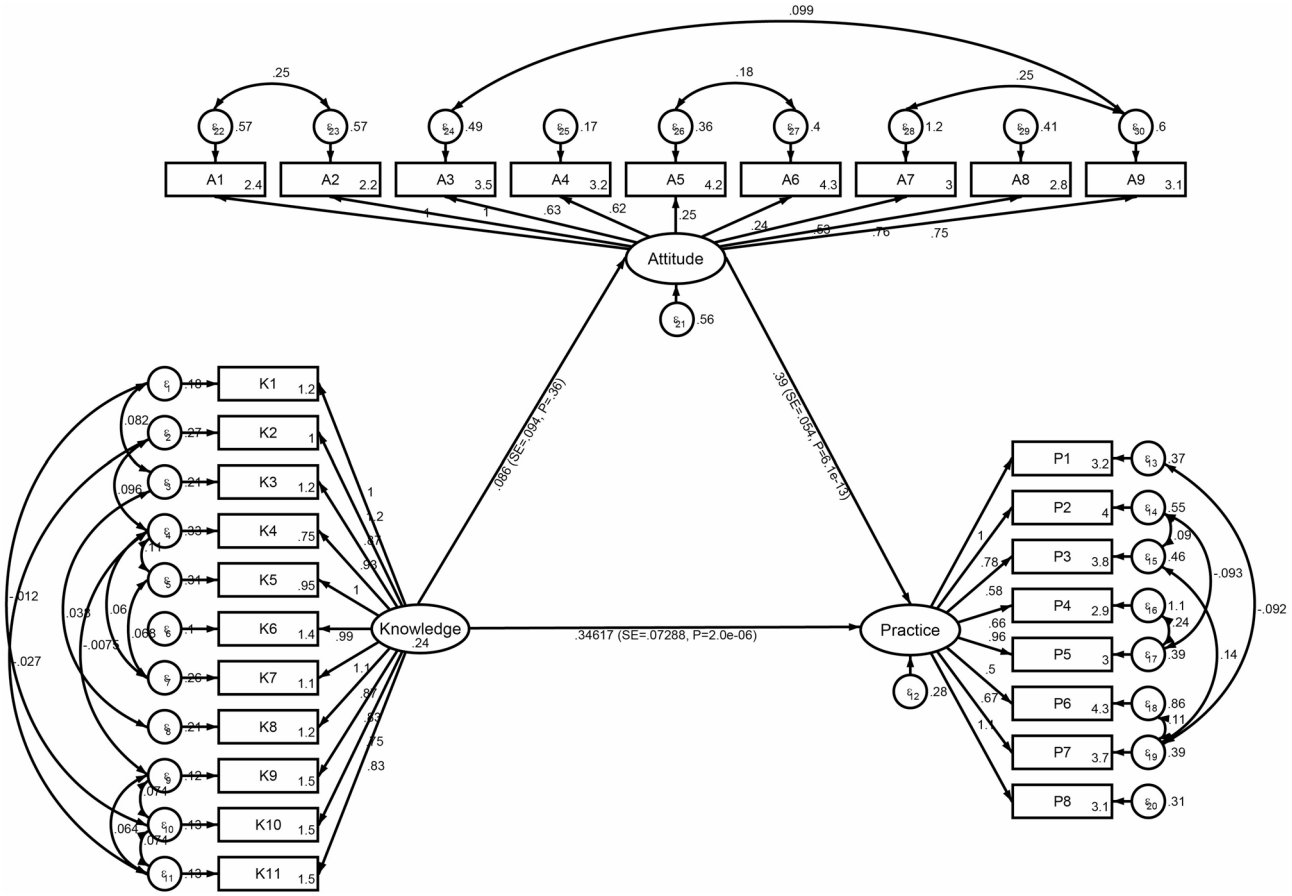

Fig. 1. Structural equation modeling depicting the relationships between knowledge, attitudes, and practices among elderly patients with MAFLD.

This study targeted on elderly patients aged 60 and above who suffer from MAFLD. The lower age limit of 60 years was chosen to account for generational differences in disease cognition and health behaviors, particularly in the context of MAFLD as a hepatic manifestation of metabolic syndrome. Elderly patients often manage multiple chronic conditions, such as cardiovascular disease and diabetes, which influence disease management. Additionally, while MAFLD onset occurs earlier in men, the incidence and severity of metabolic disorders tend to converge with age, particularly after 45 years[21,22]. Setting the threshold at 60 minimized age-related confounding, allowing for a more precise evaluation of gender differences in KAP. The limited awareness of MAFLD's progression to cirrhosis or cancer (29.95% unclear; K5) may hinder early recognition of systemic risks associated with MAFLD, as highlighted by Pipitone et al.[21,22], who characterized MAFLD as a multisystem disease linked to cardiovascular and oncological complications. This gap underscores the need for interventions addressing both hepatic and extrahepatic risks through comprehensive patient education."

This study sheds light on the substantial gaps in KAP among elderly patients with MAFLD, revealing a troubling lack of awareness, negative attitudes, and limited engagement in proactive health behaviors. These findings align with broader patterns observed in similar populations, where chronic metabolic conditions are often accompanied by insufficient understanding and suboptimal disease management[23]. For instance, studies have shown that among elderly patients with diabetes, only 35–50% exhibit adequate knowledge about disease management, which significantly affects their ability to adhere to treatment plans and engage in preventive practices[23]. Similarly, a study on cardiovascular diseases revealed that less than 40% of elderly patients were aware of the importance of lifestyle modifications, such as diet and exercise, in improving disease outcomes. In particular, the knowledge scores in this study highlight pervasive misconceptions about MAFLD, including limited awareness of its risk factors, symptoms, and potential complications. These results are consistent with studies showing that the elderly population frequently underestimates the severity of chronic liver diseases, often perceiving them as non-urgent or inevitable consequences of aging[24].

The low practice scores observed in this study further reflect a broader challenge in translating knowledge and attitudes into actionable health behaviors. Previous studies in populations with chronic conditions, such as diabetes and cardiovascular diseases, have reported similar barriers to the adoption of lifestyle modifications, often attributing them to a lack of tailored support, inadequate follow-up, and insufficient health education[25]. The limited engagement in regular exercise and dietary adjustments noted among participants mirrors trends reported in other studies of elderly patients, where physical limitations, cognitive decline, and cultural norms

regarding aging contribute to low adherence to lifestyle interventions[26]. Furthermore, the relatively low rates of health promotion and education related to MAFLD in the study population underscore systemic gaps in healthcare delivery, particularly in preventative care and patient education, which are critical for effective disease management[27,28].

Our findings on the correlations between KAP dimensions are consistent with existing health behavior models, such as the Health Belief Model, which suggests that awareness of a condition influences attitudes and subsequent behaviors[29]. Similar associations have been observed in studies on chronic diseases, where higher knowledge levels correlate with more proactive self-management behaviors[30]. However, the moderate correlation strength in our study indicates that knowledge alone may not be sufficient to drive behavior change, underscoring the need for interventions addressing attitudes and behavioral barriers. The structural equation modeling results further highlight the mediating role of attitudes in shaping practice, a pattern observed in studies on other chronic diseases where self-efficacy plays a crucial role[31]. Although our SEM model demonstrated good fit indices for RMSEA (0.068), TLI (0.877), and CFI (0.895), the SRMR value (0.110) exceeded the commonly accepted threshold of 0.08. This discrepancy may be attributed to several factors. First, the complexity of KAP relationships in elderly populations with chronic conditions like MAFLD often involves unmeasured confounding variables that influence the residual correlations between observed indicators[32]. Second, the heterogeneity in our elderly sample regarding disease duration, comorbidities, and cognitive function may have introduced additional variance not fully captured by our model specification[33]. We tested alternative model specifications including additional demographic variables and interaction terms; however, these more complex models yielded poorer overall fit indices. The current model represents the most parsimonious solution that balances theoretical coherence with empirical fit. This finding aligns with previous KAP studies in chronic disease populations where perfect model fit is challenging to achieve due to the multifaceted nature of health behaviors in elderly populations[34]. The non-significant indirect effect of knowledge on practice via attitude, as well as the lack of a direct association between knowledge and attitude, partially contradicts the classical linear assumptions of the Knowledge-Attitude-Practice model, which posits that knowledge shapes attitudes, which in turn influence behavior. These findings suggest that in older adults' self-management of MAFLD, additional mediating variables—such as self-efficacy, social support, or perceived barriers—may play a more critical role in translating knowledge into attitudes and practice[35]. Future research should explore these alternative mediators by integrating theoretical frameworks, such as the Health Belief Model or Social Cognitive Theory, to better capture the complexities of behavioral change in this population.

The differences observed in KAP scores across demographic and socioeconomic variables highlight important disparities that warrant attention. Participants with higher levels of education exhibited better knowledge and practices, which aligns with broader literature demonstrating that education is a key determinant of health literacy and the ability to navigate complex healthcare systems[36]. Similarly, income disparities significantly impacted KAP scores, with higher-income individuals demonstrating greater engagement in proactive health behaviors, reflecting well-documented inequities in access to healthcare resources and educational opportunities[37].

Age also played a critical role, as older participants were found to have lower knowledge and practice scores, consistent with studies showing that cognitive decline, limited mobility, and reduced access to information often impede effective disease management among the elderly[38]. These findings underscore the need for targeted interventions that address these disparities, particularly among vulnerable subgroups with lower socioeconomic status or advanced age.

The distribution patterns observed in specific knowledge and attitude items provide further context for understanding these gaps. Items related to the long-term complications of MAFLD, such as its progression to liver cirrhosis or cancer, received particularly low correct response rates, reflecting a broader issue in public health communication about the severity and systemic risks associated with chronic liver diseases. Similarly, the skepticism toward the efficacy of MAFLD treatment observed in attitude responses is consistent with findings from other studies, where patients with metabolic conditions often express doubts about the benefits of medical interventions, possibly due to previous negative experiences or a lack of visible improvements[39].

To address these gaps, future educational and interventional programs should incorporate evidence-based strategies tailored to the needs of elderly MAFLD patients.

First, structured health education sessions integrated into routine primary care visits have been shown to enhance patient awareness and improve outcomes. A randomized controlled trial demonstrated that lifestyle interventions including structured education significantly improved histological features of NAFLD[40]. These sessions should provide clear, actionable information on MAFLD risk factors, symptoms, and management strategies using visual aids, culturally adapted materials, and simplified language to accommodate varying literacy levels[41]. Second, evidence-based interactive workshops and peer-led support groups can foster engagement and reinforce behavior change, as studies have found that intensive lifestyle modification programs resulted in significant NASH resolution through improved adherence to recommended practices[42]. Such approaches enable patients to share experiences and receive practical guidance from healthcare professionals while improving clinical outcomes. Third, digital health interventions, such as smartphone applications or telemedicine platforms, could facilitate continuous monitoring and education, particularly for those with mobility limitations[43]. These tools can provide personalized reminders for dietary adherence, physical activity, and regular medical check-ups. Lastly, targeted public health campaigns emphasizing the importance of early detection and lifestyle modifications should be implemented in collaboration with community organizations to reach a broader audience. By integrating these approaches, healthcare systems can effectively bridge the gap between knowledge and practice, ultimately improving self-management and clinical outcomes in elderly MAFLD patients.

At the individual level, structured behavior changes programs that focus on fostering positive attitudes and building self-efficacy are essential. These could include motivational interviewing techniques and personalized

goal-setting interventions aimed at encouraging lifestyle modifications such as regular exercise and dietary adjustments. Drawing from successful chronic disease management programs, such as those for diabetes and cardiovascular health, these interventions could be adapted to the specific needs of MAFLD patients, emphasizing practical strategies for sustainable behavior change[44]. Healthcare providers should also receive additional training to equip them with the skills needed to effectively communicate with elderly patients, addressing both informational and emotional aspects of care.

Resource allocation must prioritize the development of supportive infrastructure for these interventions. This includes expanding access to affordable diagnostic tools, such as regular liver function tests, and ensuring the availability of multidisciplinary care teams, including dietitians and physical therapists, who can provide tailored support for MAFLD management. Policymakers should consider incentivizing healthcare organizations to adopt these models of care, recognizing the long-term cost-effectiveness of preventative and patient-centered approaches[45]. Finally, implementing digital health solutions, such as telemedicine platforms and mobile health apps, could further enhance accessibility, particularly for elderly patients with mobility limitations or those in underserved areas. However, these solutions must be designed with user-friendly interfaces and supported by adequate training to ensure their effectiveness and adoption[24].

This study has several limitations. First, the cross-sectional design limits our ability to infer causal relationships among KAP variables, as associations do not imply causation. Longitudinal studies are needed to determine how knowledge and attitudes influence long-term behavioral changes. Second, reliance on self-reported data introduces potential biases, including social desirability and recall bias, which may lead participants to overestimate their knowledge or adherence to recommended practices. Future studies could incorporate objective measures, such as clinical assessments or digital health monitoring, to improve data accuracy. Third, as the study was conducted at a single hospital in Shanghai, the findings may not fully represent elderly individuals with MAFLD in different healthcare settings or regions. Fourth, our quality control measures, including the exclusion of participants who failed the trap question or completed the survey too quickly, may have introduced selection bias. While these steps ensured data reliability, they may also have led to the exclusion of individuals with lower cognitive engagement or digital literacy, potentially limiting the generalizability of our findings. Fifth, the SRMR value exceeding the threshold suggests potential unexplained variance, indicating the omission of influencing factors. Attempts to incorporate additional variables led to poorer model performance, suggesting the current model is the best balance between complexity and fit. Future studies should incorporate longitudinal designs and additional variables, such as healthcare access and socioeconomic status, to refine the model and enhance understanding of KAP influences.

In conclusion, elderly patients with MAFLD demonstrated insufficient knowledge, suboptimal attitudes, and a limited engagement in proactive practices related to disease management. These findings highlight the urgent need for targeted educational interventions and awareness campaigns to enhance knowledge, foster positive attitudes, and promote effective practices among elderly patients with MAFLD, thereby improving clinical outcomes and quality of life.

Data availability

All data generated or analysed during this study are included in this published article.

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Author contributions
This article has only one author, and all contributions are attributed to Wei Li alone.

Declarations

Ethics approval and consent to participate
The study was approved by Ethics Committee of Shanghai Sixth People's Hospital (No: 2024 – 153). All participants were informed about the study protocol and provided written informed consent to participate in the study. I confirm that all methods were performed in accordance with the relevant guidelines. All procedures were performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki and its later amendments.

Competing interests
The authors declare no competing interests.

Additional information
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