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Study on Risk Factors and Integrated Medical-elderly Prevention & Control of MAFLD among the Elderly in a District of Guilin under the Healthy China Initiative

Shangyuhui Huang
Guilin Medical University
Xue Wang
Guilin Medical University
Xinyu Duan
Guilin Medical University
Tao Jiang
Guilin Medical University
Yanrui Chen
Guilin Medical University
Wei Ma
Guilin Medical University
Na Wang
Guilin Medical University
Zhihua Wang
1625654552@qq.com

Guilin Medical University

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Abstract

Against the backdrop of the Healthy China Initiative and the medical-elderly integration policies in Guangxi Zhuang Autonomous Region, this cross-sectional study explored the epidemiological characteristics of Metabolic-Associated Fatty Liver Disease (MAFLD) and its independent metabolic risk factors among 450 elderly people aged 65 years and above who received physical examinations in a district of Guilin in 2025, with demographic information, physical measurements, biochemical indicators and liver ultrasound results analyzed by SPSS 27.0 using the chi-square test, t-test, multivariate Logistic regression analysis and Spearman correlation analysis. The results showed that the overall MAFLD prevalence was 26.7% with no significant gender difference; the prevalence was obviously higher among people aged 65–70 years and those with overweight, obesity, elevated fasting blood glucose and hypertriglyceridemia ((P < 0.05)). Obesity (OR = 27.32, 95%CI: 12.411–60.146), elevated fasting blood glucose (OR = 3.34, 95%CI: 1.982–5.637) and hypertriglyceridemia (OR = 2.43, 95%CI: 1.460–4.052) were identified as independent risk factors, and alanine transaminase (ALT) had a weak positive correlation with body mass index (BMI), fasting blood glucose and triglycerides. In conclusion, MAFLD is moderately prevalent among the local elderly, and obesity as well as glucose and lipid metabolic disorders are the core pathogenic factors. Health and civil affairs departments should improve regular screening systems within the three-tier elderly care system including home-based, community-based and institutional care, implement targeted dietary interventions in light of Guilin's local dietary habits, promote collaborative prevention and control through integrated medical and elderly care, and reduce the disease burden of MAFLD in the elderly population.

1. Introduction

Metabolic-associated fatty liver disease (MAFLD) has emerged as one of the most common chronic liver conditions worldwide, closely intertwined with the rising prevalence of metabolic syndrome, type 2 diabetes, and obesity. Once MAFLD progresses to advanced stages, it is difficult to reverse and rarely resolves spontaneously, constituting a major contributor to liver-related morbidity and mortality [1]. In China, the accelerating population ageing has placed older adults' health at the forefront of public health policy. The Healthy China 2030 blueprint [2] and the 14th Five-Year Plan for National Ageing Development and Elderly Care Service System [3] explicitly prioritise healthy ageing [4]. Within the framework of active ageing [5], health management serves as the foundational pillar, alongside participation and security. MAFLD, as a metabolically modifiable disorder, offers a tangible target for implementing active-ageing strategies. In older populations, age-related declines in metabolic function and the high co-occurrence of multiple chronic conditions substantially elevate the risk of MAFLD. Currently, adults aged ≥ 65 years constitute a high-risk group for this disease. Importantly, MAFLD not only directly impairs liver function and reduces quality of life but also closely correlates with the evolution of other metabolic diseases, including type 2 diabetes and cardiovascular disorders. Thus, it is increasingly regarded as a sentinel marker of overall metabolic health [6].

The study area for this investigation is a district of Guilin City, which has a pronounced ageing profile. According to the seventh national census, permanent residents aged ≥ 65 years account for 12.51% of the district's population, with an even higher proportion in rural areas, underscoring the substantial burden of geriatric health management. To date, however, no MAFLD-focused research has been conducted among older adults undergoing health examinations in this district, leaving a gap in local prevalence data and risk-factor profiles. This deficiency hampers the implementation of precision prevention and control at the primary-care level and impedes improvements in regional elderly care services. Within China's "home-community-institution coordinated, medical-care and elderly-care integrated" service system, geriatric health management is a core component. Given that MAFLD is a prevalent metabolic condition in older adults, its prevention and control directly affect the quality of both elderly care services and life of the aged. Currently, local elderly care institutions have not incorporated MAFLD-related metabolic indicators into their health assessment protocols, and staff awareness and intervention capabilities regarding fatty liver disease remain weak. Therefore, investigating MAFLD from the perspective of elderly care service management has considerable practical relevance for this region.

Globally, a meta-analysis encompassing 78 million individuals from 38 countries reported an overall MAFLD prevalence of approximately 30%, with regional variation: South America (34%), Asia and Europe (~ 30–31%), and North America (29%). Sex-specific estimates show higher prevalence in men (36.6%) than in women (25.5%), and the rate surges to 57.5% among obese individuals [7]. MAFLD currently affects an estimated 38% of the global adult population and is the leading cause of chronic liver disease, with potential to progress to non-alcoholic steatohepatitis, cirrhosis, hepatocellular carcinoma, and liver-related death [8]. A large community-based survey in Poland (n = 3,003, mean age 79.6 years) found an overall prevalence of 37.2% in older adults, with the 65–70 age group showing the highest rate (51.4%), followed by a gradual decline with advancing age ($P < 0.0001$) [8]. In the Asia-Pacific region, a 2023 Global Burden of Disease study estimated that MAFLD affects over 120 million older adults (aged 65–89 years), with an age-standardised prevalence rate of 36,995 per 100,000 in Southeast Asia and 32,822 per 100,000 in the Western Pacific, and increasing trends from 2010 to 2019 in both regions [7].

In China, MAFLD prevalence has also been rising steadily, making it one of the most common chronic liver diseases. National data indicate an overall prevalence of 29.6% among Chinese adults, with males (34.75%) outnumbering females (23.50%) [9]. The recently published Guidelines for the Prevention and Treatment of Metabolic Dysfunction-Associated (Non-Alcoholic) Fatty Liver Disease (2024 Edition) reaffirm that MAFLD is now the most prevalent chronic liver disease in the country [10]. A risk-factor analysis among middle-aged and older adults in Beijing further confirmed the central role of metabolic abnormalities in MAFLD [11]. Collectively, obesity and metabolic dysregulation are key drivers of MAFLD in older adults, and lifestyle interventions hold promise for risk reduction.

Despite these advances, several gaps remain. Most existing epidemiological data derive from large-scale national surveys or studies conducted in major metropolitan areas; region-specific data for older adults in Guilin, Guangxi, are virtually absent. Moreover, the majority of published studies approach MAFLD from a clinical epidemiological perspective, with few integrating local dietary patterns or considering a

holistic elderly-care service framework that bridges home, community, and institutional settings. To address these gaps, the present study uses health-examination data collected in 2025 from a community health centre in a district of Guilin. Through a cross-sectional design, we aim to: (1) estimate the prevalence of MAFLD among residents aged ≥ 65 years; (2) examine its associations with sex, age, body mass index, blood pressure, fasting glucose, lipids, and liver/kidney function; and (3) identify the principal metabolic risk factors. The ultimate goal is to provide evidence-based guidance for primary-care providers to optimise geriatric health services, implement health education, and design lifestyle interventions, thereby improving the metabolic health and quality of life of the ageing population in this locality.

2. Data Sources and Research Methods

2.1 Data Collection

2.1.1 Data Source

The data for this study were obtained from the health examination records of individuals aged 65 and above in a district of Guilin in 2025, collected through the basic public health elderly health check-up program. All participants were permanent residents of the district.

2.1.2 Collection Methods

Data were systematically extracted from the center's standardized health examination archive system. The collected indicators were categorized into four groups: (1)Sociodemographic indicators: sex and chronological age.(2)Physical examination indicators: height, weight, systolic blood pressure, diastolic blood pressure, and calculated body mass index (BMI).(3)Laboratory biochemical indicators: fasting blood glucose, total cholesterol, triglycerides, alanine aminotransferase (ALT), and aspartate aminotransferase (AST), all measured using standardized automated biochemical analyzers in the laboratory.(4)Imaging indicators: liver ultrasound diagnosis results, interpreted by certified ultrasound physicians according to domestic MAFLD diagnostic and treatment guidelines to determine the presence of hepatic steatosis.

2.1.3 Sample Size Estimation

This study is a cross-sectional survey, and the sample size was calculated using the formula for prevalence studies [14].

$$n=\frac{t_{\alpha}^{2}\times P\times(1\text{-}P)}{\delta^{2}}$$

At α = 0.05, tα = 1.96; P is the disease prevalence rate; δ is the permissible error, set at 10%.

Based on the study by Yao Xiaoqin et al. [15] and considering regional differences, the expected prevalence rate for this study was set at 25%. Substituting into the formula yields n = 288. Accounting for potential non-response during data collection, the sample size was increased by 20% to N = 288/(1-0.20) = 288/0.8 = 360. To ensure statistical power for subgroup analyses (e.g., by gender or age group), the final sample size was expanded to 400–450 cases, with 450 eligible participants ultimately included in the study.

2.1.4 Diagnostic Criteria

This study adheres to the diagnostic criteria outlined in the "Guidelines for the Prevention and Treatment of Metabolic (Non-Alcoholic) Fatty Liver Disease (2024 Edition)" [16] issued by the Chinese Society of Hepatology, with diagnostic reports prepared by ultrasound physicians holding intermediate or higher professional titles.

The primary ultrasonographic features for diagnosing MAFLD include the following four core indicators: increased echogenicity in the anterior liver parenchyma, blurred visualization of intrahepatic ductal structures, posterior echo attenuation, and liver echogenicity higher than that of the renal parenchyma. A diagnosis of fatty liver is made if the first criterion is met along with at least one of the remaining three criteria. The distinction between mild-to-moderate and severe fatty liver is based on a semi-quantitative assessment of attenuation degree and ductal structure visibility.

BMI grouping follows the standards of the Chinese Obesity Working Group: normal weight is defined as 18.5–23.9 kg/m², overweight as 24.0–27.9 kg/m², and obesity as ≥ 28.0 kg/m². The normal triglyceride level is < 1.7 mmol/L, while levels ≥ 1.7 mmol/L are considered elevated. Normal fasting blood glucose is < 6.1 mmol/L, and levels ≥ 6.1 mmol/L are defined as elevated. The normal diastolic blood pressure is < 90 mmHg, and readings ≥ 90 mmHg are classified as elevated.

2.1.5 Inclusion and Exclusion Criteria

Inclusion criteria: (1) Age ≥ 65 years; (2) Complete physical examination data, including liver ultrasound results and relevant metabolic indicator test data; (3) Voluntary participation in this study and cooperation with data collection. (4) Daily alcohol intake < 20g for men and<10g for women [14], with health records indicating alcohol consumption < 1 time per week and no history of sustained drinking in the past year.

Exclusion criteria: (1) Alcohol consumption criteria: Exclude those with daily alcohol intake≥20g for men or≥10g for women; or those who consume alcohol ≥ 1 time per week and have a record of sustained drinking in the past year. (2) Suffering from viral hepatitis, autoimmune liver disease, cirrhosis, liver cancer, or other liver diseases; (3) Presence of severe cardiovascular and cerebrovascular diseases, malignant tumors, or other major illnesses that may affect study outcomes; (4) Incomplete data or refusal to participate in the study.

2.2 Research Methods

2.2.1 Literature Review

To obtain theoretical support, we systematically reviewed relevant domestic and international literature. Using databases such as CNKI, Wanfang, and PubMed, we searched for related literature with keywords like "MAFLD," "elderly," and "prevalence."

2.2.2 Statistical Analysis

The data in this study were processed and analyzed using SPSS 27.0 software.

(1) t-test: Used to compare the mean differences of continuous variables (e.g., age, BMI, biochemical indicators) between two groups. Independent samples t-test was applied when the data followed a normal distribution with homogeneity of variance, while the corrected t-test was used for unequal variances. In this study, the t-test was employed to compare the differences in various continuous indicators between the MAFLD group and the non-fatty liver group, with results presented as "mean ± standard deviation."
(2) χ^2 test: Used to compare the differences in proportions or prevalence rates of categorical variables (e.g., gender, BMI categories, blood glucose groups) between two or more groups. This study utilized the χ^2 test to analyze differences in MAFLD prevalence across genders, age groups, BMI levels, blood glucose levels, and triglyceride levels.
(3) Logistic regression analysis: Logistic regression is a regression method used to examine the relationship between a binary dependent variable (e.g., presence or absence of disease) and multiple independent variables, calculating the odds ratio (OR) for each factor to identify independent risk factors after adjusting for confounders. In this study, variables with $P < 0.05$ in univariate analysis (age, BMI, systolic blood pressure, diastolic blood pressure, blood glucose, triglycerides, hemoglobin, ALT) were included as independent variables, with MAFLD status (yes = 1, no = 0) as the dependent variable. Forward stepwise selection (Forward: LR) was applied for multivariate logistic regression analysis, with an entry criterion of $\alpha = 0.05$ and a removal criterion of $\alpha = 0.10$. The independent effects of each factor were assessed using OR values and 95% confidence intervals.

(4) Spearman rank correlation analysis: Spearman correlation is a non-parametric statistical method used to evaluate the monotonic relationship between two variables, suitable for non-normally distributed data. This study employed Spearman rank correlation to explore the associations between liver enzymes (ALT, AST) and metabolic indicators (BMI, fasting blood glucose, triglycerides). A correlation coefficient (r) closer to ± 1 indicates a stronger correlation.

3. Results

3.1 Basic Information of Study Participants

A total of 450 elderly individuals aged 65 and above were included in this study, comprising 202 males (44.4%) and 248 females (55.6%). The age range was 65–91 years, with a mean age of 71.25 ± 4.69

years. The basic characteristics of the participants are presented in Table 1.

Table 1
Basic Information of the Study Subjects

Item	Subcategory	Number (n)	Proportion (%)
Sex	Male	202	44.4
	Female	248	55.6
Age group	65–70 years	224	49.7
	71–75 years	157	34.8
	≥ 76 years	69	15.5
BMI group	Normal weight	217	48.2
	Overweight	174	38.6
	Obese	59	13.2
Fasting blood glucose	Normal	321	71.4
	Elevated	129	28.6
Triglycerides	Normal	292	64.9
	Elevated	158	35.1
Hypertension	Yes	32	7.1
	No	418	92.9

3.2 Prevalence of MAFLD

Among the 450 study subjects, 120 were diagnosed with MAFLD by ultrasound, yielding an overall prevalence rate of 26.7%. The prevalence was 27.2% in males and 26.2% in females. Although the prevalence was slightly higher in males, the difference was not statistically significant (χ^2=0.059, P = 0.808) based on the chi-square test.

Comparison across age groups:The prevalence was 32.1% in the 65–70 age group, 21.6% in the 71–75 age group, and 20.2% in the ≥ 76 age group. The prevalence decreased with increasing age (χ^2=6.885, P < 0.05).

Comparison across BMI categories:The prevalence was 8.2% in the normal-weight group, 33.3% in the overweight group, and 74.5% in the obese group. The prevalence increased significantly with higher BMI levels (χ^2=110.659, P < 0.001).

Comparison across fasting blood glucose levels:The prevalence was 19.0% in the normal blood glucose group and 45.7% in the elevated blood glucose group. The prevalence increased significantly with higher

blood glucose levels (χ^2=33.629, P < 0.001).

Comparison across triglyceride levels:The prevalence was 19.5% in the normal triglyceride group and 39.9% in the elevated triglyceride group. The prevalence increased significantly with higher triglyceride levels (χ^2=21.717, P < 0.001).

Detailed prevalence rates and intergroup comparison results are presented in Table 2.

Table 2
Prevalence of MAFLD

Group	Number	Fatty liver cases	Prevalence (%)	χ^2	P value
Overall	450	120	26.7	–	–
Sex				0.059	0.808
Male	202	55	27.2		
Female	248	65	26.2		
Age group				6.885	< 0.05
65–70 years	224	72	32.1		
71–75 years	174	34	21.6		
≥ 76 years	69	14	20.2		
BMI category				110.659	< 0.001
Normal weight	217	18	8.2		
Overweight	174	58	33.3		
Obese	59	44	74.5		
Fasting blood glucose				33.629	< 0.001
Normal	321	61	19.0		
Elevated	129	59	45.7		
Triglycerides				21.717	< 0.001
Normal	292	57	19.5		
Elevated	158	63	39.9		

3.3 Univariate Analysis of Influencing Factors for MAFLD

The study subjects were divided into the MAFLD group (120 cases) and the non-fatty liver group (330 cases), and a univariate analysis was conducted on relevant indicators. The results showed that there were statistically significant differences between the two groups in terms of age, BMI, systolic blood

pressure, diastolic blood pressure, fasting blood glucose, triglycerides, hemoglobin count, and ALT levels ($P < 0.05$). However, no statistically significant differences were observed in indicators such as platelets and white blood cells ($P > 0.05$). The specific results are presented in Table 3.

Table 3
Univariate analysis of influencing factors for MAFLD

Variable	NAFLD group (n = 120)	Non-NAFLD group (n = 330)	t value	p value
Age (years)	70.45 ± 4.65	71.54 ± 4.68	−2.193	0.029
BMI (kg/m²)	27.23 ± 3.21	23.36 ± 2.68	11.777+	< 0.001
Systolic blood pressure (mmHg)	137.96 ± 16.79	133.85 ± 15.45	2.437	0.015
Diastolic blood pressure (mmHg)	76.03 ± 10.44	72.30 ± 9.34	3.627	< 0.001
Fasting blood glucose (mmol/L)	6.78 ± 2.61	5.82 ± 1.99	3.690+	< 0.001
Total cholesterol (mmol/L)	4.92 ± 1.14	4.83 ± 1.05	0.813	0.417
Triglycerides (mmol/L)	2.35 ± 1.94	1.60 ± 1.02	4.004+	< 0.001
Hemoglobin (×10¹² g/L)	142.86 ± 14.31	136.96 ± 16.40	3.489	< 0.001
White blood cells (×10⁹/L)	6.69 ± 1.68	7.08 ± 12.24	−0.346	0.730
Platelets (×10⁹/L)	220.52 ± 53.07	220.38 ± 70.50	0.023+	0.982
Creatinine (μmol/L)	81.14 ± 25.44	80.07 ± 24.02	0.410	0.682
Blood urea nitrogen (mmol/L)	7.06 ± 10.72	6.94 ± 8.97	0.119	0.906
ALT (U/L)	31.72 ± 15.87	25.97 ± 19.07	2.952	0.003
AST (U/L)	25.31 ± 11.23	23.99 ± 10.96	1.109+	0.269

Note: + indicates unequal variance (Levene's test $p < 0.05$), and the t-test results from the "unequal variances assumed" row were used. ALT: Alanine aminotransferase; AST: Aspartate aminotransferase. $P < 0.05$ was considered statistically significant.

3.4 Multivariate Logistic Regression Analysis of MAFLD Influencing Factors

Variables with $P < 0.05$ in the univariate analysis (age, BMI, systolic blood pressure, diastolic blood pressure, blood glucose, triglycerides, hemoglobin, ALT) were included as independent variables, with the

presence or absence of MAFLD (yes = 1, no = 0) as the dependent variable in the multivariate logistic regression model. Using the presence or absence of fatty liver as the dependent variable, variables with statistical significance in the univariate analysis (BMI, blood pressure, blood glucose, triglycerides, etc.) were included as independent variables for binary logistic regression analysis (forward stepwise method). The results showed that the variables ultimately entering the regression equation were BMI, triglycerides, and fasting blood glucose (see Table 4).

The multivariate stepwise logistic regression analysis revealed that the final variables entering the model were BMI, triglycerides, and fasting blood glucose. Among them, overweight (OR = 5.053, 95% CI: 2.784–9.169), obesity (OR = 27.322, 95% CI: 12.411–60.146), elevated triglycerides (OR = 2.432, 95% CI: 1.460–4.052), and elevated fasting blood glucose (OR = 3.342, 95% CI: 1.982–5.637) were all independent risk factors for MAFLD (all P < 0.001). The Hosmer-Lemeshow test indicated good model fit (χ^2=1.739, P = 0.942) (see Table 4).

Table 4
Multivariate Logistic Regression Analysis of Influencing Factors for MAFLD

Variable	Assignment	OR	95% CI	P value
BMI				
Normal weight	0	1.00		
Overweight	1	5.053	2.784–9.169	< 0.001
Obese	2	27.322	12.411–60.146	< 0.001
Triglycerides				
Normal	0	1.00		
Elevated	1	2.432	1.460–4.052	< 0.001
Fasting blood glucose				
Normal	0	1.00		
Elevated	1	3.342	1.982–5.637	< 0.001

Note: The forward stepwise regression method (Forward: LR) was used, with the entry criterion set atα = 0.05 and the removal criterion atα = 0.10. The Hosmer-Lemeshow test showed χ^2=1.739, P = 0.942, indicating good model fit. The OR value represents the multiple of the risk of MAFLD in the exposed group relative to the reference group.

3.5 Correlation analysis between liver enzyme levels and metabolic indicators

Normality tests revealed that liver enzymes and metabolic indicators did not follow a normal distribution. Therefore, Spearman's rank correlation analysis was employed to examine the correlations between liver enzymes (ALT, AST) and metabolic indicators (BMI, fasting blood glucose, triglycerides). The results

showed that ALT was significantly positively correlated with BMI (r = 0.230, P < 0.001), fasting blood glucose (r = 0.107, P = 0.024), and triglycerides (r = 0.092, P = 0.050), although the correlation coefficients were low, indicating weak associations. AST showed only a weak negative correlation with blood glucose (r = − 0.111, P = 0.019) and no significant correlation with BMI or triglycerides (P > 0.05).

Among metabolic indicators, BMI showed significant positive correlations with blood glucose (r = 0.160, P < 0.001), BMI with triglycerides (r = 0.190, P < 0.001), and blood glucose with triglycerides (r = 0.100, P = 0.033). The above results indicate that ALT reflects metabolic disorders more effectively than AST, though the overall correlation is weak, suggesting that liver enzyme levels may be influenced by multiple factors. See Table 5.

Table 5
Correlation analysis between liver enzyme levels and metabolic indicators (Spearman correlation coefficient).

Variable	ALT	AST	BMI	Blood glucose	Triglycerides
ALT	1.000	0.622**	0.230**	0.107*	0.092*
AST	0.622**	1.000	-0.018	-0.111*	0.017
BMI	0.230**	-0.018	1.000	0.160**	0.190**
Blood glucose	0.107*	-0.111*	0.160**	1.000	0.100*
Triglycerides	0.092*	0.017	0.190**	0.100*	1.000

Note: *P < 0.01, *P < 0.05. Spearman rank correlation analysis was used, with a sample size of N = 450.

4. Discussion

4.1 The Prevalence of MAFLD Decreases with Age

The results of this study indicate that the overall prevalence of MAFLD among elderly individuals aged 65 and above in a certain district of Guilin is 26.7%, which is consistent with similar domestic studies [15]. Research by Yao Xiaoqin et al. on individuals aged 60 and above undergoing health examinations in Sichuan Province reported a prevalence rate of 28.5%[15], while another study in a district of Wuhan found a prevalence rate of 38.75% for metabolic-associated fatty liver disease among those aged 65 and above [25], higher than the findings of this study.

The reasons for this discrepancy may include: First, differences in diagnostic criteria and study years—studies in Wuhan and other regions adopted the new definition of MAFLD, which has broader inclusion criteria, leading to a higher prevalence rate. Second, regional dietary preferences vary significantly. The Wuhan region tends to favor salty, umami, spicy, and oily flavors, whereas the local diet in this study area is relatively mild. Research suggests that excessive salt intake may indirectly contribute to the development of fatty liver by interfering with insulin sensitivity and blood pressure [26].

The highest prevalence was observed in the 65–70 age group (32.1%), followed by a decline in the 71–75 (21.6%) and ≥ 76 age groups (20.2%) with increasing age ($P < 0.05$), which aligns with the trend reported by Yao Xiaoqin et al. [22]. This phenomenon can be primarily attributed to the "survivor effect": older adults in poorer health may have already passed away or dropped out of the health screening cohort at younger ages (e.g., in their 60s or 70s), while those who survive to older ages generally have better metabolic health, resulting in a lower apparent prevalence of fatty liver disease [18]. Additionally, differences in dietary habits and lifestyles during the formative years of different birth cohorts may also influence prevalence rates [26].

4.2 Obesity, elevated fasting blood glucose, and hypertriglyceridemia are associated with MAFLD.

Multivariate analysis showed that obesity was the strongest independent risk factor for MAFLD, with an associated risk 27.322 times higher than that of individuals with normal weight, and a prevalence rate as high as 74.5% in the obese group. This effect size was significantly higher than the results reported by Li Wei et al. [27] and Wei Wenfang et al. [17] (overweight/obesity OR = 4.859). The reason for this discrepancy may lie in the fact that the study subjects in this research were elderly individuals aged 65 and above, who often present with multiple metabolic abnormalities, and the larger sample size provided greater statistical stability. The findings of Xu et al. [20] also corroborate this, showing that in elderly patients with type 2 diabetes, each unit increase in waist-to-hip ratio increased the risk of MAFLD by 3.288 times, indicating that central obesity is particularly hazardous. Related studies have further confirmed that the association between obesity and MAFLD is especially pronounced in the elderly population [21]. This suggests that not only is obesity the strongest risk factor, but its distribution pattern (e.g., central obesity) is also crucial.

Individuals with elevated fasting blood glucose (FBG ≥ 6.1 mmol/L) had a 3.342 times higher risk of developing MAFLD compared to those with normal levels, which aligns with the findings of Li Wei et al. [19], who reported an OR of 1.189 for fasting blood glucose. Both studies demonstrate that elevated blood glucose is a significant risk factor. Moreover, increased blood glucose stimulates excessive insulin secretion, further disrupting the balance of fat storage and breakdown, ultimately creating a vicious cycle of mutual exacerbation [21]. Hypertriglyceridemia (TG ≥ 1.7 mmol/L) increased the risk of MAFLD by 2.432 times. If the body synthesizes too much triglycerides or fails to metabolize them adequately, they accumulate excessively in the liver. Meanwhile, MAFLD further disrupts lipid metabolism, forming another vicious cycle [21].

All three aforementioned risk factors are modifiable metabolic indicators, and lifestyle interventions can effectively reduce the risk of MAFLD. Additionally, from the perspective of Pender's Health Promotion Model [22], lifestyle changes in the elderly require emotional support through interpersonal relationships, a daily health environment built on family and community involvement, and institutional assistance to ensure professional intervention and evaluation. The synergy of these three elements can better facilitate lifestyle modifications in the elderly.

4.3 Liver enzyme levels are influenced by multiple factors.

This study demonstrates that ALT shows a significant positive correlation with BMI, fasting blood glucose, and triglycerides ($P < 0.05$), whereas the correlation between AST and these indicators is weaker. Similar to research conducted in Wuhan [17], it indicates that ALT better reflects hepatic metabolic disorders than AST. However, the correlation coefficients between ALT and metabolic indicators in this study were below 0.3, indicating weak associations, which suggests that liver enzyme levels are influenced by multiple factors (e.g., medications, infections, muscle injuries). Therefore, relying solely on ALT for screening non-alcoholic fatty liver disease has limitations. It is recommended to combine ALT with other indicators such as BMI and blood glucose in community screenings to improve accuracy.

4.4. Policy Recommendations

(1) Home-Based Elderly Care Support Policies

Systematic training on chronic disease prevention and control should be provided for home caregivers, clearly defining their responsibilities in dietary management, exercise supervision, and timely referrals, with emphasis on monitoring changes in body weight, waist circumference, blood glucose, and blood lipids; any abnormalities should activate a “family–community” closed-loop response [21, 23]. The family doctor contract system can be leveraged to incorporate dietary guidance for elderly fatty liver disease and home-based exercise instruction into free community training programs, to be delivered regularly by general practitioners and nutritionists. Free door-to-door screenings should be offered every 1–3 months to high-risk elderly individuals with obesity, hyperglycemia, or hyperlipidemia, with the cost of consumables covered by public health funds. Additionally, low-fat home recipes tailored to local Guilin rice noodle dietary habits should be developed and distributed by community workers, aiming to reduce carbohydrate intake, late-night snacking, and fried food consumption; concurrently, a two-way family–community referral pathway should be established to enable direct clinic access when abnormal indicators are detected.

(2) Universal Implementation Policies for Community Elderly Care Stations

District-level financial authorities should establish special subsidies to equip all community elderly care stations with standardized screening tools (e.g., scales, portable glucose meters, and lipid detectors), with such expenditures incorporated into the annual basic public health budget. Health education on MAFLD should be integrated into routine community public health assessments, supported by regular localized dietary workshops that promote modified eating habits based on the local rice noodle and night market cuisine. Furthermore, guidelines for elderly group activities should be issued, under which care stations routinely organize low-to-moderate intensity exercises such as square dancing, walking, and tai chi, with the integration of medical and wellness resources included as a key evaluation metric [24].

(3) Admission and Routine Supervision Policies for Elderly Care Institutions

Civil affairs and health departments should jointly revise institutional admission criteria to require metabolic indicators (BMI, fasting glucose, and triglycerides) as mandatory check-up items at intake, with the approval of facilities lacking basic testing equipment suspended until compliance is achieved. Biannual random inspections of institutional meal plans should be conducted, strictly limiting the provision of high-fat, high-sugar, and high-carbohydrate foods. Tiered care standards should be introduced based on the severity of MAFLD (mild, moderate, and severe), mandating the presence of dedicated nutritionists and rehabilitation specialists to design graded dietary and exercise regimens. Institutions that standardize the implementation of fatty liver tiered health management should receive designated operational subsidies as a policy incentive [25].

(4) District-Level Coordination and Funding Policies

An implementation guideline entitled “Rules for Comprehensive MAFLD Prevention and Control Among Residents Aged 65 and Above” should be issued to coordinate home-based, community, and institutional prevention systems. The allocation structure of public health funds should be optimized, with a greater share directed to rural and agriculture-oriented communities, and mobile medical vehicles deployed to conduct roving screenings in rural areas. Early screening and intervention for elderly fatty liver disease should be incorporated into the district’s routine basic public health services, with the program costs fully guaranteed by government finance.

4.5. Innovation

The innovation of this study is primarily reflected in three aspects: First, based on the regional characteristics of Guilin, a cross-sectional survey of MAFLD among the elderly population aged 65 and above was conducted, enriching localized baseline data research on metabolic liver diseases in the elderly within the region. This provides empirical references for local primary healthcare institutions in chronic disease screening for the elderly. Second, differing from purely clinical and epidemiological studies, the research adopts the perspective of elderly care service management, analyzing the current aging situation in Lingui District alongside the three-tier elderly care service system. Third, based on empirically identified metabolic risk factors, a targeted local healthcare-collaborative prevention and control plan was designed. The findings can directly inform decision-making for local health and civil affairs departments.

4.6 Limitations

This study has certain limitations: First, as a cross-sectional study, it can only reveal associations and cannot determine causality. Second, the study participants were drawn solely from a single public health service center's physical examination population, which may introduce selection bias; thus, caution is needed when generalizing the results to the broader population. Additionally, the data collection process did not fully account for detailed lifestyle factors such as dietary patterns, exercise habits, and smoking or drinking history. The non-standardized assessment of alcohol consumption history may lead to

misclassification bias, potentially influencing the study findings. Future research could employ cohort studies to further clarify causal relationships between various factors and MAFLD, expand the scope of the study to include more lifestyle-related factors, and provide more comprehensive evidence for prevention and control.

5. Conclusions

The findings of this study indicate that the overall prevalence of metabolic-associated fatty liver disease (MAFLD) among individuals aged 65 and above in Lingui District, Guilin City, is 26.7%, placing it at a moderate level compared to similar domestic regional surveys. Multivariate logistic regression analysis confirmed that obesity, hypertriglyceridemia, and elevated fasting blood glucose are independent risk factors for MAFLD in this elderly population. Additionally, significant positive correlations were observed among the three metabolic indicators: BMI, fasting blood glucose, and triglycerides. Study participants were strictly enrolled based on alcohol consumption limits and originally classified as having non-alcoholic fatty liver disease (NAFLD). In accordance with the Guidelines for the Prevention and Treatment of Metabolic-Associated (Non-Alcoholic) Fatty Liver Disease (2024 Edition), they were uniformly included in the MAFLD statistical framework.

These three risk factors are modifiable metabolic markers amenable to lifestyle interventions, making them highly suitable for routine monitoring and health management in various elderly care settings. In community-based elderly care facilities, portable glucose and lipid testing devices can be deployed to conduct regular MAFLD screenings. Within residential care institutions, it is recommended to incorporate BMI, blood glucose, and lipid levels into admission assessments and daily health records. A multidisciplinary team comprising caregivers, nutritionists, and rehabilitation specialists should collaborate to implement weight management, dietary guidance, and exercise interventions. Although alanine aminotransferase (ALT) shows weaker correlation with metabolic indicators, its ease of testing and low cost make it a practical component for preliminary screenings when combined with BMI and blood glucose, enhancing efficiency in community-based fatty liver detection.

Guided by active aging and social support theories, local primary healthcare institutions should sustain MAFLD health education and personalized lifestyle interventions. District-level health and civil affairs departments can leverage the empirical data from this study to establish a chronic disease management system integrating medical and social services with multidisciplinary collaboration. MAFLD screening and intervention efforts should be comprehensively embedded across the three-tiered elderly care system encompassing home, community, and institutional care. By strengthening resource sharing and operational coordination between healthcare providers and elderly care entities, the risk of MAFLD onset in the local aging population can be mitigated at its source, improving both physical and mental health outcomes. The results of this study provide epidemiological evidence and practical references for standardizing and advancing the integrated medical-elderly care services in LinGui District.

Declarations

Ethics approval and consent to participate

This study retrospectively analyzed anonymized routine physical examination data without direct contact with participants. In accordance with Article 32 of China's *Ethical Review Measures for Biomedical Research Involving Humans* (National Health Commission Order No. 11, 2023), research using lawfully obtained existing anonymous data that does not involve identifiable private information is exempt from formal ethics review. The study protocol was voluntarily submitted to and acknowledged by the Medical Ethics Committee of Guilin Medical University. Informed consent was waived due to the retrospective and anonymized nature of the data.

Consent for publication

Not Applicable

Availability of data and materials

The original contributions presented in the study are included in the article. Further inquiries can be directed to the corresponding author.

Competing interests

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Authors' contributions

S.H., X.W. and X.D.: Data curation, Formal analysis, Software, Validation, Writing – original draft. T.J., Y.C. and W.M.: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Writing – original draft. N.W. and Z.W.: Conceptualization, Funding acquisition, Project administration, Resources, Supervision, Writing – review & editing. All authors contributed to the article and approved the submitted version.

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