Relationship between the metabolic associated fatty liver disease and endometrial thickness in postmenopausal women: a cross-sectional study in China

Supplementary material

Figures and Tables:

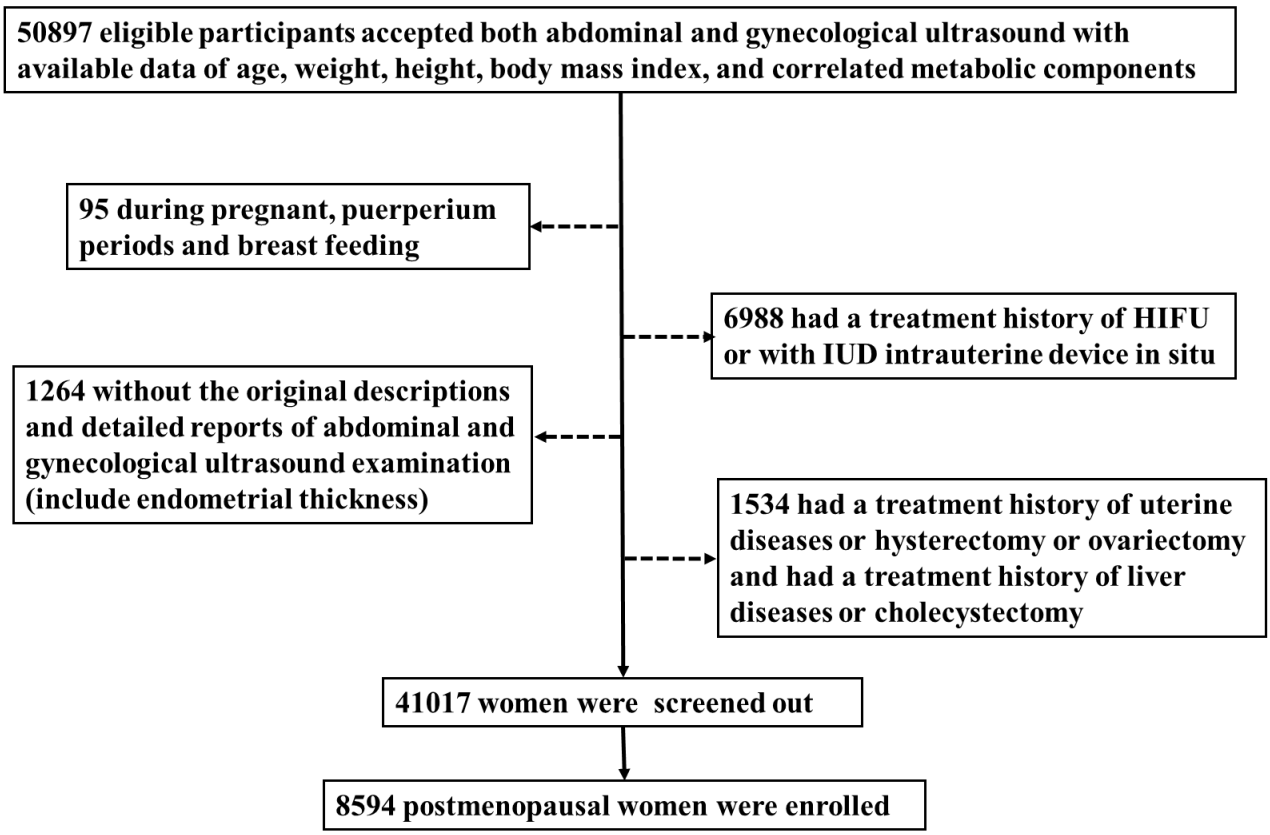

Figure 1 Flow chart of study participants.

Figure 1: A total of 50897 women participated in this study of whom 8594 were postmenopausal. Among the postmenopausal women,381(4.4%) had an ET greater than or equal to 5 mm, of whom 137 (36.0%) presented with fatty liver based on transabdominal ultrasonography and 133 (34.9%) presented with MAFLD.

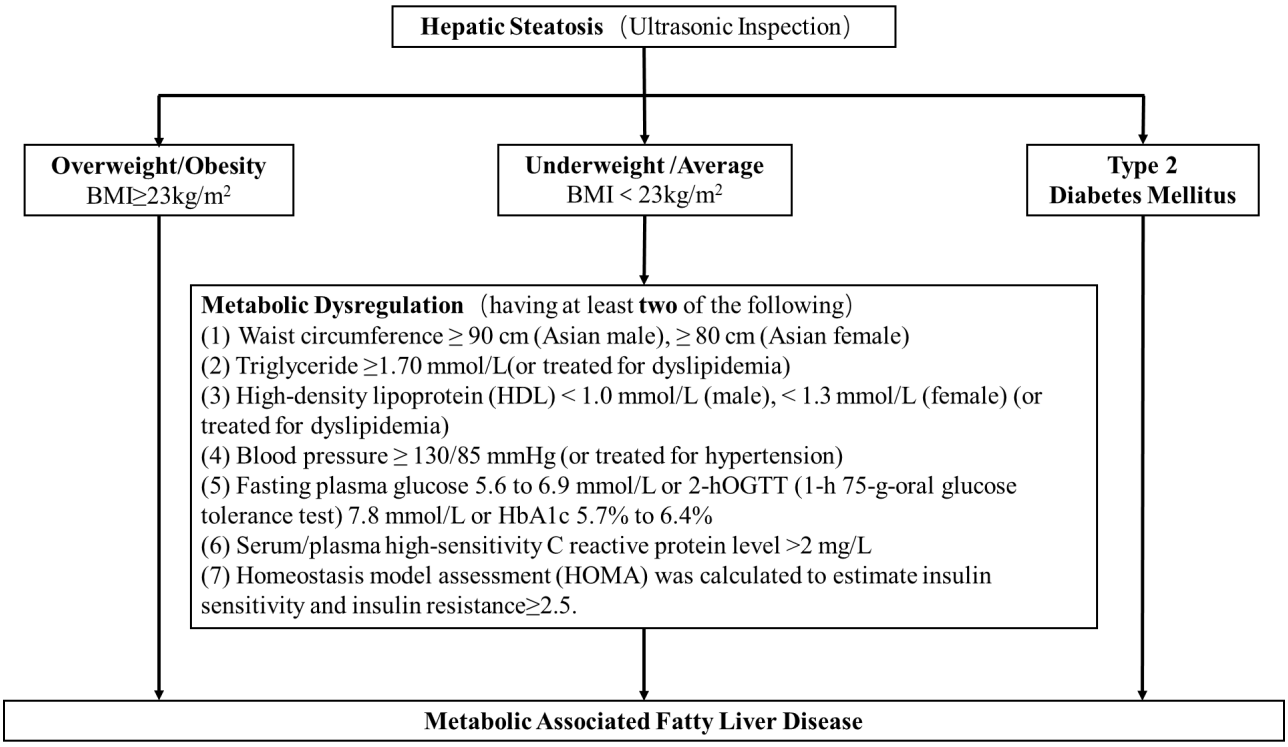

Figure 2 The diagnostic criteria of MAFLD.

Figure 2: The diagnostic criteria of MAFLD are based on evidence of hepatic steatosis, one of the following three criteria, namely overweight/obesity, presence of type 2 diabetes mellitus, or evidence of metabolic dysregulation3 which was defined as having at least two of the following; (1) waist circumference ≥ 90 cm (Asian male), ≥ 80 cm (Asian female), (2) triglyceride ≥1.70 mmol/L(or treated for dyslipidemia), (3) high-density lipoprotein (HDL) < 1.0 mmol/L (male), < 1.3 mmol/L (female) (or treated for dyslipidemia), (4) blood pressure ≥ 130/85 mmHg (or treated for hypertension), (5) fasting plasma glucose 5.6 to 6.9 mmol/L or 2-h OGTT (1-h 75-g-oral glucose tolerance test (OGTT) 7.8 mmol/L or HbA1c 5.7% to 6.4%, (6) serum/plasma high-sensitivity C reactive protein level >2 mg/L, (7) homeostasis model assessment (HOMA) 2 was calculated to estimate insulin sensitivity and insulin resistance≥2.5.

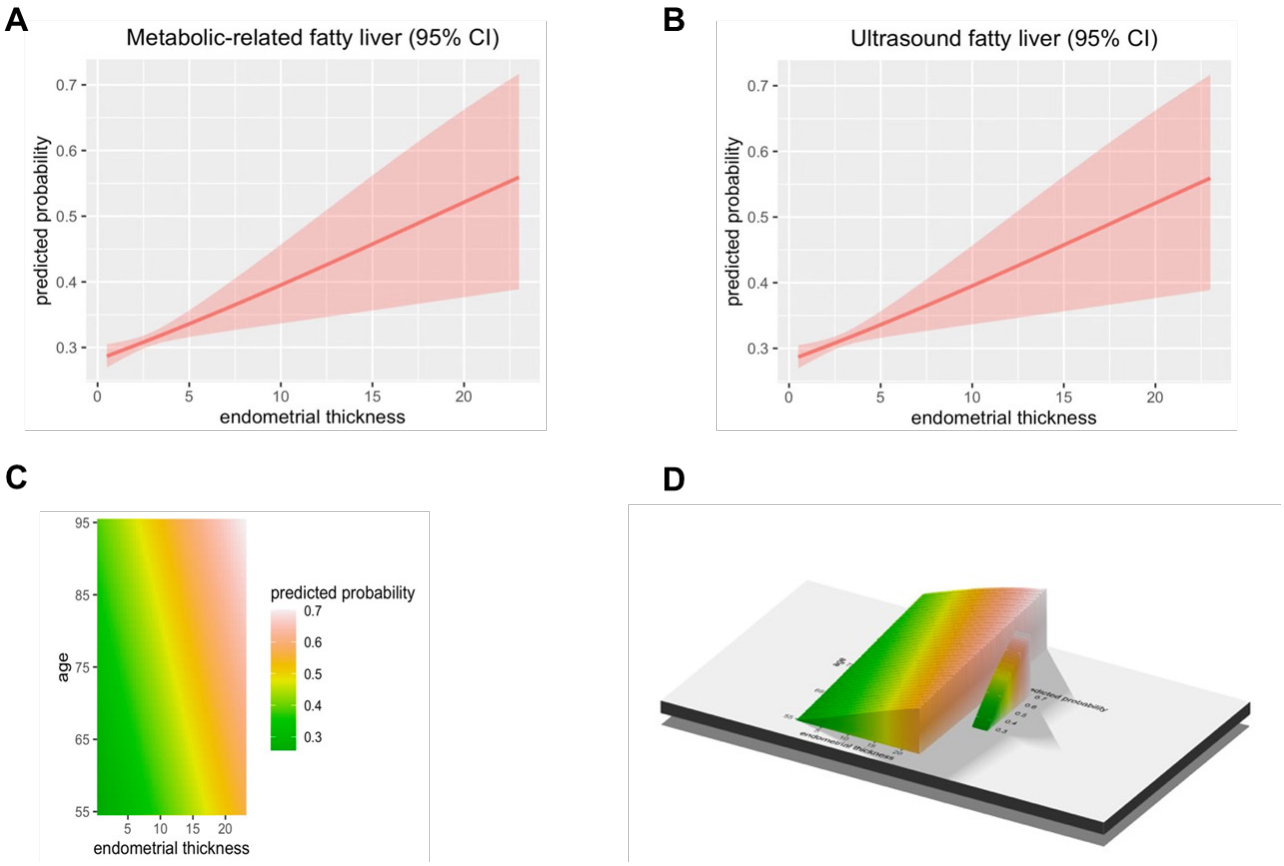

Figure 3 The predicted probability of metabolic associated fatty liver disease (MAFLD) and ultrasound based fatty liver disease.

Figure 3: (A) The Endometrial thickness predicting the presence of Metabolic associated fatty liver disease were examined by the R.(B) The Endometrial thickness predicting the presence of Ultrasonic fatty liver were examined by the R.(C-D) The Endometrial thickness and age predicting the presence of FLD were examined by the R.

Table 1 Characteristics of women included in the study (n=8594) by endometrial thickness. [a]

	Endometrial thickness (n=8594)		
	< 5mm (n=8213)	≥5mm (n=381)	*P* value [b]
Baseline characteristic			
Age, y	63. 55 [6.70]	62.30[6.76]	< 0.001
Height, cm	154.27[5.64]	155.21 [6.06]	0.005
Body mass index [c]			
BMI	23.55 [3.03]	24.34[3.05]	< 0.001
Underweight < 18.5	272(3.3%)	0(0.0%)	0.001
Average18.5~22.9	3459 (42.1%)	481(18.1%)	
Overweight≥23~24.9	2080 (25.3%)	738(27.7%)	
Obese I ≥25~29.9	2194(26.7%)	1265(47.5%)	
Obese II ≥30	208(2.5%)	179(6.7%)	
Metabolic components [d]			
Waist circumference			
Waist, cm	79.85 [7.89]	81.74[7.85]	< 0.001
Normal	3982(48.5%)	135(35.4%)	< 0.001
Elevated≥80cm	4231(51.5%)	246(64.6%)	
Blood pressure			
SBP, mmHg	133.25[19.86]	135.07[20.68]	0.091
DBP, mmHg	76.48[11.05]	77.40[12.34]	0.249
Normal	3603 (43.9%)	156(40.9%)	0.261
Elevated≥130/85 mmHg	4610 (56.1%)	225(59.1%)	
Triglycerides			
Triglycerides, mmol/L	1.64[1.15]	1.60[0.80]	0.671
Normal	5484(66.8%)	247(64.8%)	0.432

Elevated≥1.7 mmol/L	2729(33.2%)	134(35.2%)	
HDL			
HDL-C, mmol/L	1.61[0.37]	1.56[0.34]	0.017
Normal	6630(80.7%)	289(75.9%)	0.019
Reduced < 1.3 mmol/L	1583(19.3%)	92(24.1%)	
Fasting blood sugar			
Fasting glucose, mmol/L	5.76[1.35]	5.81 [1.34]	0.522
Normal < 5.6 mmol/L	4625(56.3%)	205(53.8%)	0.492
Elevated 5.6~6.9 mmol/L	2849(34.7%)	136(35.7%)	
Type 2 diabetes > 6.9 mmol/L	739(9.0%)	40(10.5%)	

a. Values are given as mean [std. deviation] and number (percentage).

b. Some P values were compared using Kruskal-Wallis tests. Other variables were derived from $\chi 2$ tests.

c. Cut-off values of body mass index were defined as follows: underweight **<** 18.5; average18.5~22.9; overweight≥23~24.9; obese I ≥25~29.9; obese II ≥30.

d. Cut-off values of metabolic components were defined as follows: waist circumference ≥80 cm; systolic blood pressure ≥130 mm Hg or diastolic blood pressure ≥85 mm Hg; triglycerides ≥1.7 mmol/L; HDL cholesterol < 1.3 mmol/L; fasting glucose from 5.6 to 6.9 mmol/L.

Table 2 The risk of metabolic associated fatty liver disease (MAFLD) and ultrasound-based fatty liver disease in relation to endometrial thickness. [a]

Endometrial thickness / mm	**Liver status**				
	Total	Model 1		Model 2	
	（n=8594）	Ultrasonic fatty liver[b]（-）（n=5931）	Ultrasonic fatty liver（+）（n=2663）	MAFLD[c]（-）（n=6051）	MAFLD（+）（n=2543）
< 3	4720(54.9%)	3303 (70.0%)	**1417 (30.0%)**	3368(71.4%)	**1352(28.6%)**
3≤ET < 5	3493(40.6%)	2384(68.3%)	**1109 (31.7%)**	2435(69.7%)	**1058(30.3%)**
≥5	381(4.4%)	244 (64.0%)	**137 (36.0%)**	248(65.1%)	**133(34.9%)**

a. Data are given as a number (%).

b. Ultrasonic fatty liver means fatty liver disease diagnosed by abdominal or gynecological ultrasonography.

c. MAFLD means metabolic associated with fatty liver disease.

Table 3 The odds ratio for metabolic associated fatty liver disease (MAFLD) and ultrasound-based fatty liver disease in relation to endometrial thickness.

Endometrial thickness / mm	**Liver status**				
	Total（n=8594）	Model 1		Model 2	
		Ultrasonic fatty liver（+）（n=2663）		MAFLD（+）（n=2543）	
	number (%)	OR (95%CI)[a]	P value	OR (95%CI)[b]	P value
< 5	8213(95.6%)	1 (Reference)	0.032	1 (Reference)	0.020
≥5	381(4.4%)	**1.264 (1.020 -1.566)**		**1.291(1.041-1.603)**	

a. OR: odds ratio; 95%CI: 95% confidence interval.

b. The odds ratio of fatty liver disease is adjusting for nothing.

Table 4 Binary logistic regression analysis for metabolic associated fatty liver disease (MAFLD) and ultrasound-based fatty liver disease in relation to endometrial thickness.

	Liver status			
	Ultrasonic fatty liver[a] (+) (n=2663)		MAFLD (+) (n=2543)	
	OR (95%CI) [b]	P_{trend}	OR (95%CI)	P_{trend}
Binary model 1				
Endometrial thickness, mm	**1.052(1.017-1.089)**	0.003	**1.056(1.021-1.093)**	0.002
ET < 3 mm	1 (Reference)	0.025	1 (Reference)	0.018
3mm ≤ET < 5 mm	1.084 (0.986-1.192)	0.093	1.082 (0.983-1.191)	0.106
ET≥5mm	**1.309 (1.052-1.628)**	0.016	**1.336 (1.072-1.665)**	0.010
Binary model 2				
Age[c], y	1.015(1.008-1.022)	< 0.001	1.018(1.012-1.025)	< 0.001
Endometrial thickness, mm	**1.060(1.024-1.096)**	0.001	**1.065(1.029-1.102)**	< 0.001
ET < 3 mm	1 (Reference)	0.008	1 (Reference)	0.004
3mm ≤ET < 5 mm	**1.107 (1.007-1.218)**	0.036	**1.110 (1.008-1.223)**	0.034
ET≥5mm	**1.347 (1.082 -1.676)**	0.008	**1.383 (1.109-1.724)**	0.004

a. Ultrasonic fatty liver means fatty liver disease diagnosed by abdominal or gynecological ultrasonography.

b. The odds ratio of fatty liver disease is adjusting for age.

c. In models, age and endometrial thickness were treated as a continuous variable.

Table 5 Multivariable adjusted analysis for BMI in relation to endometrial thickness.

	Endometrial thickness, mm[b]			
	3mm ≤ ET < 5 mm		ET ≥ 5 mm	
	OR (95%CI)	P_{trend}	OR (95%CI)	P_{trend}
Age, y	1.050(1.032-1.068)	< 0.001	1.016(0.998-1.035)	0.073
Body mass index[a]				
Average **18.5≤BMI≤22.9**	1.337(0.756-2.366)	0.318	1.192(0.671-2.118)	0.549
Overweight **BMI≥23~24.9**	**1.795(1.005-3.203)**	**0.048**	1.430(0.798-2.563)	0.230
Obese I **BMI≥25~29.9**	**2.458(1.388-4.354)**	**0.002**	**1.821(1.024-3.238)**	**0.041**
Obese II **BMI≥30**	**3.409(1.343-8.654)**	**0.010**	**2.562(1.002-6.550)**	**0.050**

a. The body mass index is divided into 5 groups according to Asian BMI classification.

b. Underweight BMI < 18.5: 1 (Reference)