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Risk factors and community intervention for nonalcoholic fatty liver disease in community residents of Urumqi, China

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Abstract

This study is to investigate the prevalence and risk factors of nonalcoholic fatty liver disease (NAFLD) and to analyze the effect of comprehensive community intervention on NAFLD in community residents in Urumqi, China.

Cluster sampling method with street community as a unit was adopted in this study. Questionnaire survey, body measurement, blood biochemistry (including liver function, fasting blood glucose [FPG], and uric acid [UA]) examination as well as liver B ultrasound were performed. Then, comprehensive intervention was conducted in NAFLD patients.

A total of 1000 people were enrolled, including 344 men and 656 women, with an average age of 51.79 ± 4.28 years. Of them, 660 were Han Chinese, 327 were Uygur, and 13 were Hui. The overall prevalence rate of NAFLD was 54.3%. The prevalence rate of NAFLD is higher in middle-aged population and is higher in ethnic minority than that in Han. NAFLD was associated with the past medical history of metabolic diseases. The factors of body mass index (BMI), systolic blood pressure (SBP), diastolic blood pressure (DBP), waist circumference, hip circumference, neck circumference, subcutaneous fat thickness, FPG, alanine aminotransferase, and aspartate aminotransferase were identified as risk factors for NFALD. Neck circumference predicts the occurrence of NAFLD in female better, whereas subcutaneous fat predicts the occurrence of NAFLD in male better. After 8 months of community intervention in NAFLD patients, the changes of BMI, SBP, DBP, waist circumference, neck circumference, subcutaneous fat thickness, and UA were statistically significant ($P < .05$).

The prevalence rate of NAFLD is high in Urumqi, China. Community intervention is effective in reducing the degree of NAFLD and promoting the overall health of NAFLD patients.

Abbreviations: ALT = alanine aminotransferase, AST = aspartate aminotransferase, BMI = body mass index, DBP = diastolic blood pressure, FPG = fasting plasma glucose, NAFLD = nonalcoholic fatty liver disease, SBP = systolic blood pressure, UA = uric acid.

Keywords: community intervention, nonalcoholic fatty liver disease, prevalence rate, risk factors

1. Introduction

Nonalcoholic fatty liver disease (NAFLD) is a genetic, environmental, and metabolic and stress associated liver disease without history of excessive drinking and is characterized by steatosis and fat storage in liver parenchymal cells.[1] The disease spectrum of NAFLD includes nonalcoholic simple fatty liver, nonalcoholic steatohepatitis, liver fibrosis, liver cirrhosis, and hepatocellular carcinoma.[2] As a reversible disease, early detection, intervention, and treatment of NAFLD can cure the majority of patients.[3] NAFLD is a part of the metabolic syndrome, associated with many metabolic features, such as obesity, hypertension, diabetes, and hyperlipidemia.[4] In Europe, the overall prevalence rate of NAFLD among adults is 20% to 34%, among which the prevalence rate in Sweden, Germany, Spain, and Italy is 39.0%, 40.0%, 25.8%, and 25.0%, respectively.[5–7] The prevalence rate of NAFLD is 5% to 28%, 12%, 17%, and 5% in India, Philippines, Malaysia, and Singapore, respectively.[8] NAFLD affects 20% to 30% of the total population in North America, with prevalence rates of 30% in the United States and 25% in Canada.[9] In China, NAFLD affects about 5% to 24% of the population.[8] Thus, NAFLD is already a global public health issue.

Study has shown that the prevalence rate of NAFLD is associated with the age of patients.[10] China is a populous country and has become an aging population society.[11] However, the prevalence and the risk factors of NAFLD in middle-aged population are still unclear. In this study, the prevalence rate of NAFLD in the middle-aged population in Urumqi, China and its main risk factors were investigated. Comprehensive intervention was performed on the screened NAFLD patients.

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2. Materials and methods

2.1. Subjects and data collection

This is a cross-sectional study. The communities of Fuxing and Beiyuanchun in Shayibake District and the communities of Heju and Qidaowan East Street in Shuimogou District in Urumqi, China were investigated. All subjects were asked by the investigators to fill in the questionnaire using a unified questionnaire. The questionnaire was designed due to the diet structure and living behavior of the local residents in Xinjiang and included general information, past history, eating habits, lifestyle habits, physical measurement indicators, and laboratory tests. Physical measurements including height, body mass, blood pressure, waist circumference, hip circumference, neck circumference, and triceps parts were performed, and the body mass index (BMI) was calculated. Then, 5 mL of the venous blood (at least fasting for more than 8 hours) was collected for blood biochemical tests. Finally, the abdominal B ultrasound was performed.

The inclusion criteria were as follows:

(i) Subjects were in line with the diagnostic criteria of NAFLD.
(ii) The age of subject was between 45 and 59 years.
(iii) Subjects with clear awareness and able to answer questions correctly and move freely.
(iv) Subjects were local residents living in the community for more than 2 years.
(v) Informed consent was obtained from each subject who voluntarily participated in this study.

The exclusion criteria were as follows:

(i) Patients with alcoholic fatty liver disease. For long-term drinkers, generally more than 5 years, those with alcohol consumption ≥40 g/day in men and ≥20 g/day in women were excluded. For drinkers with large alcohol consumption in 2 weeks, those with alcohol consumption >80 g/day[12] were excluded.
(ii) Subjects were with hepatitis such as viral hepatitis (hepatitis C, hepatitis B, and others), drug-induced hepatitis, and cirrhosis.
(iii) Subjects were patients with malignant tumors.
(iv) Subjects were with woman acute gestational fatty liver or specific types of liver diseases such as Reye syndrome, Wilson disease, glycogen accumulation disease, and autoimmune liver disease.
(v) Subjects were with industrial toxic contact history such as carbon tetrachloride, yellow phosphorus, dimethyl nitrosamines, and diethyl nitrosamines.
(vi) Subjects refused to participate in this study.

Prior written and informed consent were obtained from every patient and the study was approved by the ethics review board of Xinjiang Medical University.

2.2. Diagnosis of NAFLD

NAFLD was diagnosed according to the previously described diagnostic criteria.[13] Patients were diagnosed as NAFLD if they met the 3 following diagnostic criteria: Subject had no history of drinking or alcohol consumption <140 g ethanol per week in men and <0 g ethanol per week in women; Subject did not have specific diseases that can cause fatty liver, such as viral hepatitis, drug-induced liver disease, total parenteral nutrition, hepatolenticular degeneration, and autoimmune liver disease; and Liver imaging of subjects was consistent with the diagnostic criteria for diffuse fatty liver. Ethanol amount conversion was calculated according to the equation as described previously: ethanol (g) = alcohol consumption (mL) × ethanol content (%) × 0.8 (ethanol specific gravity). The ethanol content was defined as 12% of the wine, 4% of the beer, 16% of rice wine, and 40% of liquor.

2.3. Intervention

The NAFLD patients were then randomly divided into intervention group and control group. Routine intervention was used in the control group. Routine and community intervention were used in the intervention group. The intervention time was 8 months. Briefly, routine intervention included setting up the NAFLD Prevention Bulletin, issuing NAFLD health education brochure, long-term placement of NAFLD promotional materials in the community, and conducting NAFLD health education seminar and exchange. Community intervention included establishing community health files for chronic diseases, targeted guidance to patients with NAFLD and other metabolic diseases (such as maintaining the BMI at 18.5–23.9 kg/m^2 and monitoring blood pressure and blood glucose level), guiding the development of healthy lifestyles (such as encouraging aerobic exercise), dietary guidance for patients according to the severity of the disease (such as gradually reducing the intake of high fever, high fat, and high sugar food), monthly telephone follow-up, and home visits to the patients 1 time every 2 months.

2.4. Statistical analyses

Statistical analyses were performed using SPSS 17.0 (IBM-SPSS, Chicago, IL). The general demographic data of the subjects were described by the frequency and composition ratio. The results were expressed as the mean ± SD. The χ^2 test was used to compare the prevalence rate of NAFLD in community residents with different demographic characteristics. The t test was used to compare the clinical observation indicators between the NAFLD patients and the normal population. The risk factors of NAFLD were analyzed by logistic regression analysis. The receiver operating characteristic curve was used to analyze the predictive value of obesity indexes in the incidence of NAFLD in female and male. When there was the homogeneity of variance and normality, 2 independent samples t test was used to compare the 2 sets of measurement data after intervention. When there was normality, but not the homogeneity of variance, t test was used. A P value less than 0.05 was considered statistically significant.

3. Results

3.1. Basic characteristics of included subjects and prevalence rate of NAFLD

A total of 1000 people were selected, including 34.4% of men and 65.6% of women, with an average age of 51.79 ± 4.28 years, height of 1.60 ± 0.08 m, and weight of 67.38 ± 12.23 kg. Of them, 66% were Han, 32.7% were Uygur, and 1.3% were Hui (Table 1). Wherein, 543 cases of the patients were diagnosed with NAFLD, with the overall prevalence rate of 54.3% (Table 1). The prevalence rate of NAFLD in female patients (64.2%) was higher than that in male patients (35.5%), and the differences were statistically significant (Table 1). The prevalence rates of NAFLD in Uygur and Hui (63.9% and 61.5%, respectively) were higher than that in Han (49.4% of Han), and the differences were statistically significant (Table 1). These indicate that women are more likely to have NAFLD than men, and ethnic minorities are

Table 1

Basic characteristics of included subjects.

Factor		Number of people surveyed	Number of cases with NAFLD	NAFLD prevalence rate, %	χ^2	*P*
Gender	Male	344	122	35.5	74.97	.000
	Female	656	421	64.2		
Ethnicity	Han	660	326	49.4	18.86	.000
	Uyghur	327	209	63.9		
	Hui	13	8	61.5		
Education	Primary	398	246	61.8	31.24	.000
	Junior high school	381	201	52.8		
	High school or secondary school	162	81	50.0		
	Junior college	41	12	29.3		
	Undergraduate and above	18	3	16.7		
Occupation	None	375	204	59.7	29.47	.000
	Commercial and service personnel	299	174	55.2		
	Workers and technical staff	163	91	49.7		
	Civil servants	67	17	29.9		
	Farmers	56	38	67.9		
	Other	40	19	37.5		

Table 2

Relationship between the past medical history of metabolic disorders and nonalcoholic fatty liver disease (NAFLD).

	No		Yes			
Past medical history	N	NAFLD detection rate, %	N	NAFLD detection rate, %	χ^2	*P*
Diabetes	627	49.3 (309)	373	62.7 (234)	271.375	.000
Hypertension	773	44.6 (345)	277	56.0 (155)	223.886	.000
Hyperlipidemia	802	51.5 (413)	198	65.7 (130)	295.530	.000
Cholecystitis	916	53.6 (491)	84	61.9 (52)	360.488	.000
Cholelithiasis	897	53.3 (478)	103	63.1 (65)	344.004	.000

more likely to have NAFLD than Han in the middle-aged community.

3.2. Association of past medical history and NAFLD

NAFLD is closely related to metabolic disorders.[14] Diabetes and hypertension are important risk factors for NAFLD.[15,16] The correlation between past medical history of metabolic disorders and NAFLD was investigated in this study. As shown in Table 2, the NAFLD prevalence rates in patients with diabetes, hypertension, hyperlipidemia, cholecystitis, and cholelithiasis were 62.7%, 56.0%, 65.7%, 61.9%, and 63.1%, respectively. The NAFLD prevalence rates of patients without diabetes, hypertension, hyperlipidemia, cholecystitis, and cholelithiasis were 49.3%, 44.6%, 51.5%, 53.6%, and 53.3%, respectively. The NAFLD prevalence rates of patients with metabolic disorders were significantly higher than those of patients without metabolic disorders ($P<.05$). These results indicate that the prevalence of NAFLD is closely related to diabetes, hypertension, hyperlipidemia, cholecystitis, and cholelithiasis in community residents in Urumqi, China.

3.3. Analysis of risk factors for NAFLD

To analyze the risk factors for NAFLD, physical examination was performed. The clinical observations of patients with NAFLD were compared with those without NAFLD. As shown in Table 3, BMI, systolic blood pressure (SBP), diastolic blood pressure (DBP), waist circumference, hip circumference, neck circumference, subcutaneous fat thickness, fasting plasma glucose (FPG), alanine aminotransferase (ALT), and aspartate aminotransferase (AST) levels in NAFLD patients were different from those without NAFLD. The differences were statistically significant ($P<.05$). This implies that these factors may have correlations with NAFLD.

Next, multivariate logistic regression analysis was performed to further analyze the risk factors of NAFLD. Results showed that BMI, SBP, DBP, waist circumference, hip circumference, neck

Table 3

Comparison of the indexes between the patients with NAFLD and those without.

Index	NAFLD patients (n=543)	Patients without NAFLD (457)	*t*	*P*
BMI, kg/m^2	28.1±4.0	24.5±3.8	−14.412	.000
SBP, mm Hg	135±19	130±18	−3.651	.000
DBP, mm Hg	85±12	83±13	−2.687	.007
Waist circumference, cm	94.7±10.5	86.7±11.0	−11.818	.000
Hip circumference, cm	103.1±8.3	97.3±7.9	−11.313	.000
Neck circumference, cm	35.7±3.4	35.1±4.0	−2.654	.000
Subcutaneous fat thickness, cm	31.7±8.4	25.4±9.3	−11.192	.000
FPG, mmol/L	5.8±2.1	5.5±1.7	−2.871	.004
UA, μmol/L	318.3±83.9	311.6±91.4	−1.209	.227
ALT, U/L	40.9±53.2	29.8±21.5	−4.165	.000
AST, U/L	28.1±15.4	25.1±11.1	−3.530	.000

The *t* test was used to compare of the 2 groups. ALT=alanine aminotransferase, AST=aspartate aminotransferase, BMI=body mass index, DBP=diastolic blood pressure, FPG=fasting plasma glucose, NAFLD=nonalcoholic fatty liver disease, SBP=systolic blood pressure, UA=uric acid.

Table 4

Multivariate logistic regression analysis of related factors of NAFLD.

Index	B	W	OR	95%CI Lower	Upper	*P*
BMI, kg/m^2	0.208	29.395	1.231	1.142	1.327	.000
SBP, mm Hg	0.003	0.251	1.003	0.990	1.017	.616
DBP, mm Hg	0.003	0.099	1.003	0.983	1.024	.753
Waist circumference, cm	0.048	11.747	1.049	1.021	10.078	.001
Hip circumference, cm	0.003	0.042	0.997	0.964	1.030	.838
Neck circumference, cm	0.203	39.631	0.816	0.766	0.869	.000
Subcutaneous fat thickness, cm	0.037	13.750	1.038	1.018	1.058	.000
FPG, mmol/L	0.105	6.102	1.110	1.022	1.207	.013
UA, μmol /L	0.000	0.044	1.000	0.998	1.002	.835
ALT, U/L	0.025	13.678	1.025	1.012	1.038	.000
AST, U/L	0.031	6.102	0.970	0.947	0.994	.014

The risk factors of NAFLD were analyzed by multivariate logistic regression analysis. ALT = alanine aminotransferase, AST = aspartate aminotransferase, BMI = body mass index, DBP = diastolic blood pressure, FPG = fasting plasma glucose, NAFLD = nonalcoholic fatty liver disease, SBP = systolic blood pressure, UA = uric acid.

circumference, subcutaneous fat thickness, FPG, ALT, and AST levels were associated with NAFLD (Table 4). The correlation was statistically significant ($P < .05$), suggesting that these factors may be risk factors for NAFLD.

Additionally, we plotted the receiver operating characteristic curve to analyze the predictive value of obesity indexes in the incidence of NAFLD in female and male. The results showed that the area under the curve of waist circumference, hip circumference, subcutaneous fat, and neck circumference were 0.711, 0.668, 0.652, and 0.649, respectively, in male (Fig. 1A) and 0.790, 0.760, 0.697, and 0.710, respectively, in female, respectively (Fig. 1B). This indicates that neck circumference predicts the occurrence of NAFLD in female population better, whereas subcutaneous fat predicts the occurrence of NAFLD in men better.

3.4. The effect of comprehensive intervention on patients with NAFLD

The 543 NAFLD patients were randomly divided into intervention and control group. After 8 months of intervention, a total of 462 people completed the follow-up. Totally 81 patients were censored. Of them, 3 patients were died, 30 patients dropped out of the study, 10 patients were hospitalized, and 38 patients were lost contact. The demographic data of the intervention (n = 220) and control group (n = 242) were compared. The results showed that there was no significant difference in age, sex, ethnicity, educational level, and occupational type between the 2 groups ($P > .05$, Table 5).

To study the effect of comprehensive intervention on patients with NAFLD, the imaging features of B ultrasound in the liver of the 2 groups were compared before and after the intervention. The prevalence rates of NAFLD patients of the 2 groups were firstly compared before the intervention. Result showed that there was no significant difference between the 2 groups ($\chi^2 = 1.667$, $P = .434$; data not shown). This suggests that the prevalence rate of the 2 groups were comparable. After intervention, 20 patients were cured in the intervention group and 8 patients were cured in the control group. In intervention group, there was statistically significant difference in the number of patients before and after intervention (Table 6). However, the difference was not obvious in control group (Table 6). These results show that comprehensive intervention has a good effect on the cure of NAFLD.

Next, the body measurements of the 2 groups were compared before and after the intervention. As shown in Table 7, BMI, SBP, DBP, waist circumference, hip circumference, neck circumference, subcutaneous fat thickness, FPG, uric acid (UA), ALT, and AST levels had no significant difference between the 2 groups before intervention. After intervention, BMI, SBP, DBP, waist circumference, hip circumference, neck circumference, subcutaneous fat

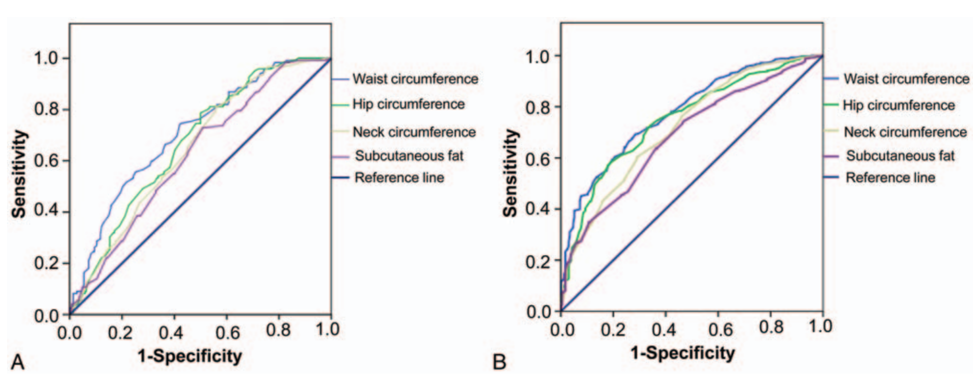

Figure 1. ROC curve of obesity indexes. ROC curve was used to analyze the predictive value of obesity indexes in the incidence of NAFLD in female and male. (A) ROC curve in male. Area under the curve of waist circumference, hip circumference, subcutaneous fat, and neck circumference in male were 0.711, 0.668, 0.652, and 0.649, respectively. (B) ROC curve in female. Area under the curve of waist circumference, hip circumference, subcutaneous fat, and neck circumference in female were 0.790, 0.760, 0.697, and 0.710, respectively. NAFLD = nonalcoholic fatty liver disease, ROC = receiver operating characteristic.

Table 5

Comparison of demographic data between the intervention and control group.

Demographic information		Intervention group (n=220) Cases	Intervention group (n=220) Percentage, %	Control group (n=242) Cases	Control group (n=242) Percentage, %	χ^2/t^*	*P*
Age		50.92±4.18	–	51.29±4.38	–	−1.327	.185
Gender	Female	55	25.00	57	23.55	0.131	.717
	Male	165	75.00	185	76.45		
Ethnicity	Han	120	54.55	149	61.57	2.338	.126
	Minority[†]	100	45.45	93	38.43		
Education[‡]	Primary	100	45.45	108	44.63	0.097	.999
	Junior high school	85	38.64	94	38.84		
	High school or secondary school	30	13.64	35	14.46		
	Junior college	5	2.27	5	2.07		
Occupation	None	77	35.00	86	35.54	0.164	.992
	Commercial and service personnel	70	31.82	76	31.40		
	Workers and technical staff	41	18.64	43	17.77		
	Civil servants	7	3.18	9	3.72		
	Farmers	17	7.73	19	7.85		
	Other	8	3.63	9	3.72		

[*] Age was compared by *t* test, and others were compared by χ^2 test.
[†] Minorities include Uygur and Hui. Uygur were 97 and 90 in the intervention and control group, respectively. Hui were 3 and 3 in the intervention and control group, respectively.
[‡] The patients with undergraduate and above education levels were censored during follow-up.

thickness, FPG, UA, ALT, and AST levels were changed in the 2 groups (Table 7). The changes of these indexes in the intervention and control groups were compared. Results showed that there were significant differences in BMI, DBP, waist circumference, subcutaneous fat thickness, and FPG in the intervention group before and after intervention ($P<.05$) (Table 8). Although the differences in BMI, SBP, waist circumference, and subcutaneous fat in control group before and after intervention were significantly different ($P<.05$) (Table 8). These indicate that community intervention is effective in reducing the degree of NAFLD.

4. Discussion

NAFLD is a common clinical chronic liver disease, widely distributed in the world.[17] NAFLD affects 20% to 40% of the population in Western countries.[18] The prevalence rate of NAFLD is 5% to 24% in China,[8] and there are gender, age, and regional differences.[19–23] In this study, the total prevalence rate of NAFLD was 54.3% in Urumqi, significantly higher than other parts of China.[19–23] The prevalence rate of NAFLD of Uighur was very high. It is reported that the NAFLD prevalence rate of

Table 6

Comparison of abdominal ultrasonography before and after intervention.

Group	n		Total number of patients with NAFLD	Severe NAFLD	Moderate NAFLD	Mild NAFLD	χ^2	*P*
Intervention	220	Before intervention	220	30	60	130	8.464	.015
		After intervention	200	20	35	145		
Control	242	Before intervention	242	52	75	115	1.424	.491
		After intervention	234	45	65	124		

NAFLD=nonalcoholic fatty liver disease.

Table 7

Comparison of the indexes between the intervention and control group before and after intervention.

Group	Intervention group (n=220)				Control group (n=242)			
Intervention period	Before	After	*t*	*P*	Before	After	*t*	*P*
BMI, kg/m^2	26.14±3.29	25.63±3.76	−1.047	.004	25.95±3.30	25.51±4.15	1.523	.026
SBP, mm Hg	134±17	121±17	5.855	.731	133±17	133±20	0.551	.018
DBP, mm Hg	85±11	79±10	6.591	.049	86±11	85±12	0.769	.069
Waist circumference, cm	92.15±9.23	87.31±12.83	4.543	.000	92.63±10.91	91.55±9.24	−0.511	.036
Hip circumference, cm	101.15±7.41	98.79±9.05	2.955	.055	101.79±8.23	100.02±7.24	−0.870	.057
Neck circumference, cm	35.97±3.57	34.89±3.78	3.083	.355	36.02±6.72	35.88±3.52	−0.156	.120
Subcutaneous fat thickness, cm	29.99±6.27	26.97±10.10	3.770	.000	30.61±6.72	29.37±9.14	0.852	.000
FPG, mmo1/L	5.93±2.11	5.33±1.06	−2.771	.000	5.78±2.09	5.48±1.08	4.718	.065
UA, μmol/L	332.95±81.04	313.10±93.40	2.381	.057	330.02±80.93	324.79±83.26	1.065	.293
ALT, U/L	30.84±16.84	30.72±16.15	0.075	.734	30.29±16.41	31.02±15.59	−1.453	.405
AST, U/L	24.81±8.53	24.18±8.43	0.815	.674	24.79±8.25	25.28±8.08	−0.569	.790

The *t* test was used to compare the control group with the intervention group. ALT=alanine aminotransferase, AST=aspartate aminotransferase, BMI=body mass index, DBP=diastolic blood pressure, FPG=fasting plasma glucose, SBP=systolic blood pressure, UA=uric acid.

Table 8

Comparison of the changes of indexes between the intervention and control group.

Index	Intervention group (n=220)	Control group (n=242)	*t*	*P*
BMI, kg/m^2	−0.51±4.84	0.56±5.35	−2.255	.025
SBP, mm Hg	9.37±22.96	1.11±25.33	3.660	.000
DBP, mm Hg	6.68±14.35	1.05±16.67	3.868	.000
Waist circumference, cm	4.84±15.28	1.08±14.31	2.727	.007
Hip circumference, cm	2.36±12.02	1.76±11.28	0.551	.582
Neck circumference, cm	1.08±5.00	0.13±5.23	1.980	.048
Subcutaneous fat thickness, cm	3.02±11.84	1.24±11.64	3.902	.000
FPG, mmo1/L	0.48±1.09	0.33±1.29	0.421	.483
UA, μmol/L	19.85±121.33	5.23±114.30	2.287	.023
ALT, U/L	0.12±23.48	2.83±25.09	−1.194	.233
AST, U/L	0.66±12.22	0.50±12.24	0.143	.886

The *t* test was used to compare of changes in the index between the two groups. Changes of indexes = the index of after intervention − the index of before intervention. ALT = alanine aminotransferase, AST = aspartate aminotransferase, BMI = body mass index, DBP = diastolic blood pressure, FPG = fasting plasma glucose, SBP = systolic blood pressure, UA = uric acid.

people with age ≥40 years was significantly higher than that of other age groups.[24] The age of the subjects were between 45 and 59 years in this study, and thus the NAFLD prevalence rate was relatively high. Cai [25] reported that the Uygur was more susceptible to NAFLD than other ethnic groups. This may be another reason leading to the high prevalence rate of NAFLD. Additionally, the diet of people in Xinjiang is mainly consisted of high fat and protein food[26] due to the long and cold winter, which may also result in the high prevalence rate of NAFLD.

Our result also showed that the NAFLD prevalence rate of women was higher than that of men. This may be because that the majority of minority women in Xinjiang were mainly housewives with less physical labor after marriage.[27] Middle-aged women were prone to abdominal obesity.[28] The NAFLD prevalence rates of Uygur and Hui were higher than that of Han, which may be related to the dietary structure of various ethnic groups. The minorities generally eat more meat and less vegetables and seafood, and lack outdoor sports.[29] The NAFLD prevalence of people with less education level was higher than that of people with higher education level. Thus, the popularization of NAFLD health control knowledge is particularly important.

Study has shown that NAFLD is closed related to obesity, diabetes, hypertension, hyperlipidemia, and other metabolic syndromes.[30] Patients with metabolic syndrome have a higher risk of NAFLD in 4 to 11 times than normal people.[7] Therefore, the American Society of Clinical Endocrinologists lists NAFLD as one of the components of metabolic syndrome in 2003.[31] This study showed that the detection rate of NAFLD in patients with diabetes, hypertension, hyperlipidemia, cholecystitis, and cholelithias was high and that patients with hyperlipidemia had the highest detection rate of NAFLD (65.7%). It is shown that the prevalence rate of fatty liver in patients with hyperlipidemia is higher than that of persons with normal blood lipids, and patients with high triglycerid and total cholesterol have the highest prevalence rate of fatty liver.[32] The prevalence rate of fatty liver in patients with severe hypertriglyceridemia and mixed hyperlipidemia is 5 to 6 times higher than that of normal persons.[33] Therefore, these results suggest that active treatment of hyperlipidemia and effective lowering of blood lipid levels, especially triglyceride levels of is important to the prevention and control of fatty liver.

Multivariate logistic regression analysis showed that BMI, waist circumference, subcutaneous fat, FPG, and ALT were risk factors for NAFLD. Obesity is one of the independent risk factors for NAFLD.[34] BMI is an indicator of the overall obesity.[35] Waist circumference is an indicator of abdominal fat accumulation.[36] Subcutaneous fat is an important indicator of upper body fat content.[37] Xiang et al[38] have shown that the risk of fatty liver in overweight, degree I obesity, and degree II obesity group increased by 1.7, 1.9, and 9.1 times, respectively, compared with the normal body mass group. Ma et al[39] have found that the risk of fatty liver is higher in people with large waist circumference (>85 cm in male and >80 cm in female). These findings indicate that BMI management is the key to prevent NAFLD. Serum ALT is used as a marker of liver disease. Elevated serum ALT in patients with NAFLD mainly reflects the severity of liver inflammation rather than steatosis or hepatic fibrosis.[40] These suggest that serum ALT alone is not enough for the evaluation of NAFLD, and other clinical metabolic markers are needed.

This study also found that neck circumference predicts the occurrence of NAFLD in female better, whereas subcutaneous fat predicts the occurrence of NAFLD in men better. This may be because that under similar abdominal subcutaneous fat and visceral fat, men have less neck fat than women.[41] Additionally, the male triceps subcutaneous fat is greater than female in the same age group. For males, the subcutaneous fat layer reaches peak at the age of 50. Although for females, body fat in all parts rapidly accumulates at the age of 20 to 30, and rapidly thinned at the age of 50 to 60.[42]

Studies have found that many diseases are closely related to the poor lifestyles.[43] To prevent and treat these diseases, lifestyle intervention is the basic measure of disease control, and health education is the basis for the implementation of lifestyle intervention.[44] Studies have shown that health education can improve the initiative and compliance of therapeutic lifestyle in NAFLD patients.[3,45,46] In this study, intervention results showed that the number of NAFLD patients in intervention group decreased after intervention. However, the difference was not obvious in control group. The changes of body measurements were statistically significant between the intervention and control group. These indicate that comprehensive intervention has a good effect on the cure of NAFLD. Stunkard et al proposed behavioral therapy, which requires patients to correct the wrong way of lifestyle.[47] Dietary intervention can make more reasonable diet for NAFLD patients. Choosing low-calorie, low-sugar, low-fat, high-protein, and high-fiber foods is conducive to lipoprotein synthesis, removing fat accumulation in the liver and promoting liver cell regeneration, thereby improving fatty liver.[48] Aerobic exercise has a certain role in the prevention and treatment of NAFLD, which can improve liver histopathology and liver function.[49]

However, this study is a cross-sectional study, which has some limitations. For example, the prevalence and distribution of the disease and the etiological assumptions can be obtained from cross-sectional study. However, the causal relationship between disease and etiology cannot be determined. Therefore, this study cannot determine the causal relationship between NAFLD and its related factors. Cohort studies are warranted to further investigate the causal relationship between the relevant factors and the disease.

In conclusion, the prevalence rate of NAFLD is high in Urumqi. The risk factors of NAFLD in middle-aged population of Urumqi are BMI, blood pressure, neck circumference, waist circumference, hip circumference, subcutaneous fat thickness, FPG, UA, ALT, and AST. Community intervention is effective in reducing the degree of NAFLD. For NAFLD patients, health education and the change in bad habits could reduce the risk of NAFLD.

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