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Original Article

The prevalence and adverse profiles of fatty liver disease among different ethnic public servants in Urumqi of Xinjiang Uygur Autonomous Region in China

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Abstract: Background: The purpose of this survey was to confirm the prevalence and adverse profiles of fatty liver disease among different ethnic public servants in Urumqi of Xinjiang. Methods: The cross-sectional study were implemented among serving and retired public servants who participated in the annual physical check-up including abdominal ultrasonography from April 2012 to April 2013 at the health promotion center of the First Affiliated Hospital of Xinjiang Medical University in Urumqi. The information including questionnaires, anthropometric indexes and biochemical profiles were collected to analyze. Results: There were 46612 individuals ranging from 20 to 93 years of age included in the analysis. There were 39120 of Han, 4148 of Uygur, 877 of Kazakh, 2098 of Hui, and 369 of other ethnic groups. The prevalence of FLD in total, Han, Hui, Uygur, Kazakh and other ethnic group were 32.0%, 31.2%, 31.5%, 39.3%, 36.4% and 32.8%. Uygur was significantly higher than the other ethnic groups both male and female ($P < 0.01$) and male was higher than female regardless of ethnicity ($P < 0.01$). FLD co-exiting with DM, hypertension, obesity, overweight and dysliplidemia (especially for hypertriglyceridemia) were common and distribution of these diseases were significantly different among various ethnicity ($P < 0.01$). Multiple logistic regression analysis indicated that there were different in adverse factors including age, gender, DM, obesity, dyslipidemia and hypertension of FLD among ethnicity and obesity having higher OR value in each ethnic group can be as predictive index of FLD. Conclusions: The high prevalence of FLD is present among public servants in Urumqi of Xinjiang, China. The prevalence of FLD is significantly different in different ethnic groups and genders. Distributions of adverse factors are disparate in different ethnicity. Comprehensive strategies for the prevention and treatment of FLD should be explored basing on the ethnic differences.

Keywords: Fatty liver, prevalence, adverse profiles, public servants, ethnicity

Introduction

With the rapid development of the society, especially the change of lifestyle and diet structure, consistently risen incidence of fatty liver disease (FLD) dividing into alcoholic fatty liver (AFL) and non-alcoholic fatty liver (NAFL) [1, 2] has become a severe threat to human health problem in recent years. FLD ranging from simple hepatic steatosis to steatohepatitis may gradually progress to fibrosis, cirrhosis and hepatocellular carcinoma [3], furthermore, hepatic steatosis which can lead to the incident or deterioration of insulin resistance is also closely relative to the occurrence of type 2 diabetes, metabolic syndrome, ischemic heart disease and atherosclerosis [4, 5].

By far, FLD has already become one of important chronic diseases and aroused general concern in the world. In western countries, the prevalence of FLD reported ranges from 20% to 60% [6], meanwhile, several surveys results had been published in general population of the prevalence of FLD detected by ultrasonography in China and displayed 26% in Guangzhou [7], 12.5% in Chengdu [8], 35.1% in Beijing [9], 20.8% in Shanghai [10], 12.5% to 24.5% between 1995 and 2004 in the Shuiguohu district of Wuhan city [11]. These surveys mainly recruited Chinese Han population.

Although, the reason is actually unknown with regard to ethnic differences in hepatic steatosis, available investigations displayed that the prevalence of FLD was distinctly disparate in ethnic groups [12-15]. Urumqi is a multi-ethnic gathering city. There are more than 13 long-dwelling ethnic groups in the region. These ethnic differences in regard to the prevalence and presenting profiles of FLD, particularly in public servants, have been limitedly investigated in China. Existing study showed that the prevalence of FLD in Han was 26.8% in Urumqi of 2008 [16], another survey reported in Han and Uygur were 35.91% and 44.32% in Urumqi of 2011 [17].

However, they simply included Han and Uygur from health checkups population and recruited small samples.

Therefore, a cross-sectional survey was conducted that purposes was to comprehend the prevalence and adverse profiles of FLD concerning different ethnic public servants (Han, Uygur, Kazakh, Hui and other ethnic groups) in Urumqi of Xinjiang Uygur Autonomous Region in China, which enrolled 46612 participants.

Materials and methods

Study population

We implemented the cross-sectional study among serving and retired public servants who fulfill public responsibility and are members of the state administrative system with wages and welfare supplied by the state public finance [18]. All subjects participated in the annual physical check-up including abdominal ultrasonography from April 2012 to April 2013 at the health promotion center of the First Affiliated Hospital of Xinjiang Medical University. Subjects were ruled out from the study due to incomplete medical information and severe heart, liver, or kidney disease. Ultimately, there were 46612 individuals ranging from 20 to 93 years of age included in the analysis. Thereinto, Han, Uygur, Kazakh, Hui and other ethnic groups (Manchu, Mongolian, Xibe and others) had 39120, 4148, 877, 2098 and 369 participants respectively.

This study was approved by the Ethics Committee of The First Affiliated Hospital of Xinjiang Medical University and written informed consent was obtained from each participant.

Physical examination

For all participants, questionnaires were collected by members of the health promotion center, which including the demographic information, medical history, drug therapy. Anthropometric variables were measured by experienced doctors for physical examination. Height was measured to the nearest 1cm without shoes and body weight to the nearest 1 kg with individuals wearing in light clothing. Body mass index (BMI) was calculated as weight in kilograms divided by height in meters squared. Systolic blood pressure (SBP) and diastolic blood pressure (DBP) were obtained using a calibrated mercury sphygmomanometer according to standard operating procedure.

Biochemical detection

Venous blood was drawn from each subject in the morning after overnight fast. Biochemical parameters were detected by automatic biochemistry analyzer (Hitachi 7060, Hitachi Ltd., Tokyo, Japan) in the Clinical Laboratory Department of The First Affiliated Hospital of Xinjiang Medical University. We collected the following data: the plasma levels of triglycerides (TG), total cholesterol (TC), high-density lipoprotein Cholesterol (HDL-C), low-density lipoprotein cholesterol (LDL-C), and fasting plasma glucose (FBG).

Diagnostic criteria

Subjects with systolic blood pressure ≥ 140 mmHg or diastolic blood pressure ≥ 90 mmHg or history of hypertension were diagnosed, in accordance with the 2010 Chinese guidelines for the management of hypertension [19]. Diabetes mellitus (DM) was defined as fasting serum glucose (FBG) ≥ 7.0 mmol/L or previously diagnosed diabetes mellitus basing on the WHO 1999 criteria [20]. The definition of dyslipidemia were one or more following serum lipid profiles: TG ≥ 1.70 mmol/l, TC ≥ 5.18 mmol/L, HDL-C ≤ 1.04 mmol/L, LDL ≥ 3.37 mmol/L according to Chinese guidelines on prevention and treatment of dyslipidemia in adults [21]. On the base of the redefined World Health Organization criterion in the Asia Pacific Region [22], overweight was defined as BMI ≥ 23.0 kg/

Table 1. Characteristics of all participants by ethnicity in Urumqi

Characteristics	Han (n = 39120)	Hui (n = 2098)	Uygur (n = 4148)	Kazakh (n = 877)	Other ethnic group (n = 369)	*P* valve
Age (years)	42.48±13.52[b,e]	41.79±13.57[a]	42.12±11.81	42.81±12.96[e]	41.09±13.19[a,d]	0.02
TG (mmol/l)	2.09±1.77[b,c]	1.99±1.77[a,c]	2.34±1.96[a,b,d,e]	2.06±1.81[c]	1.93±1.76[c]	< 0.01
TC (mmol/l)	4.43±1.47[b,c]	4.30±1.44[a,d]	4.27±1.73[a,d,e]	4.47±1.96[b,c]	4.46±1.48[c]	< 0.01
SBP (mmHg)	119.82±17.70[d]	119.60±18.17[d]	119.60±17.28[d]	123.16±18.99[a,b,c,e]	119.70±18.29[d]	< 0.01
DBP (mmHg)	76.04±11.92[c,d]	75.51±12.41[d]	74.95±11.69[a,d]	77.22±12.50[a,b,c,e]	74.90±12.15[d]	< 0.01
LDL-C (mmol/l)	2.84±0.78[c,d]	2.81±0.78[cd]	2.98±0.82[a,b,d,e]	3.05±0.91[a,b,c,e]	2.88±0.79[c,d]	< 0.01
HDL-C (mmol/l)	1.34±0.35[b,c,d,e]	1.31±0.33[a,d,e]	1.31±0.34[a,d,e]	1.37±0.35[a,b,c,e]	1.43±0.35[a,b,c,d]	< 0.01
GLU (mmol/l)	5.10±1.15[b,c,e]	5.16±1.32[a,e]	5.15±1.43[a,e]	5.07±1.29[e]	4.92±0.76[a,b,c,d]	< 0.01
Weight (kg)	68.29±13.02[c,d,e]	68.61±13.46[c,d,e]	72.22±14.06[a,b,d,e]	74.88±15.05[a,b,c,e]	70.21±13.49[a,b,c,d]	< 0.01
Height (cm)	167.50±8.58[c,d]	167.37±8.56[c,d]	166.59±8.63[a,b,d]	168.44±8.76[a,b,c]	167.31±8.53	< 0.01
BMI (kg/m^2)	24.22±3.49[c,d,e]	24.38±3.68[c,d,e]	25.94±4.23[a,b,d,e]	26.30±4.39[a,b,c,e]	24.99±3.91[a,b,c,d]	< 0.01

Compared with the Han, [a]P < 0.05; Compared with the Hui, [b]P < 0.05; Compared with the Uygur, [c]P < 0.05; Compared with the Kazakh, [d]P < 0.05; Compared with the other ethnic group, [e]P < 0.05.

Table 2. Prevalence of FLD in different ethnicity and gender

Ethnicity	FLD in total (%)	FLD in male (%)	FLD in female (%)	χ^2 value	*P* value
Han	12196/39120 (31.2)	8956/22081 (40.6)	3240/17039 (19.0)	2080.56	< 0.01
Hui	660/2098 (31.5)	450/1082 (41.6)	210/1016 (20.7)	106.36	< 0.01
Uygur	1629/4148 (39.3)	1044/2160 (48.3)	585/1988 (29.4)	155.17	< 0.01
Kazakh	319/877 (36.4)	222/490 (45.3)	97/387 (25.1)	38.28	< 0.01
Other ethnic group	121/369 (32.8)	71/185 (38.4)	50/184 (27.2)	5.25	0.02
Total	14925/46612 (32.0)	10743/25998 (41.3)	4182/20614 (20.3)	2337.22	< 0.01
χ^2 value	121.07	52.98	130.68	-	-
P value	< 0.01	< 0.01	< 0.01	-	-

m^2 but BMI < 25.0 kg/m^2 and obesity was defined as BMI ≥ 25.0 kg/m^2.

Experienced ultrasound physicians were responsible for abdominal ultrasound examination using an ultrasound instrument (LOGIQ E9, GE, America) with a 3.5 MHz probe. FLD was diagnosed by any two of the following three ultrasonic features: liver and kidney echo discrepancy and presence of increased liver echogenicity (bright), unclear intrahepatic duct structure, liver far field echo decay [23].

Statistical analysis

The statistical analysis was handled with the Statistical Package for Social Sciences (SPSS) software package version 16.0 for Windows (SPSS Inc., Chicago, IL, USA). Continuous variables were given as mean and standard deviation (SD), the comparisons among different ethnic groups on these variables were performed with one-way ANOVA tests. Categorical variables summarized in percentage were analyzed with chi-square test. Logistic regression analyses (univariate and multivariate) were used to analyze the risk factors for FLD and odds ratio (OR) with 95% confidence interval (CI) were calculated. A receiver operating characteristic (ROC) curve was operated to evaluate the predictive value of FLD and area under curve (AUC) with 95% CI were calculated. Two tailed tests were performed and the level less than 0.05 was statistical significance.

Results

General characteristics of subjects

The general characteristics of all ethnic groups were illustrated in **Table 1**. Age, TG, TC, SBP, DBP, LDL-C, HDL-C, GLU, Weight, Height and BMI were significantly different in various ethnic groups (P < 0.05) and the further results of multiple comparisons were showed in **Table 1**.

Prevalence of FLD

Table 2 displayed that the prevalence of FLD in total, Han, Hui, Uygur, Kazakh and other ethnic

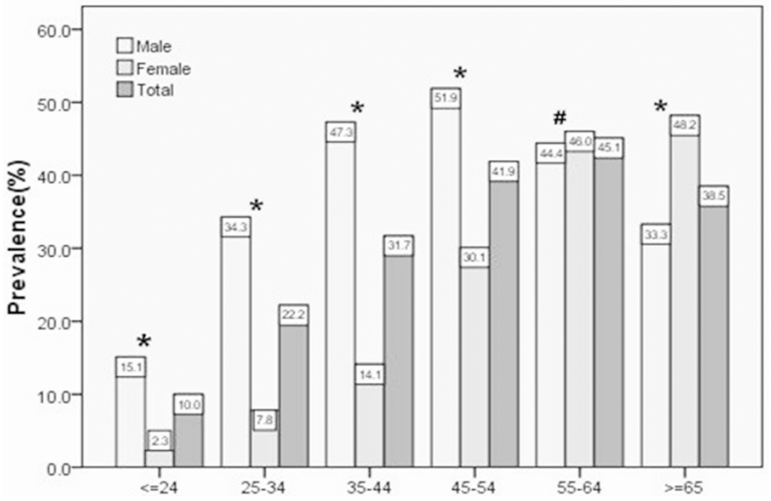

Figure 1. Prevalence of FLD in various age groups. Male Vs Femal, *P < 0.01, #P > 0.05.

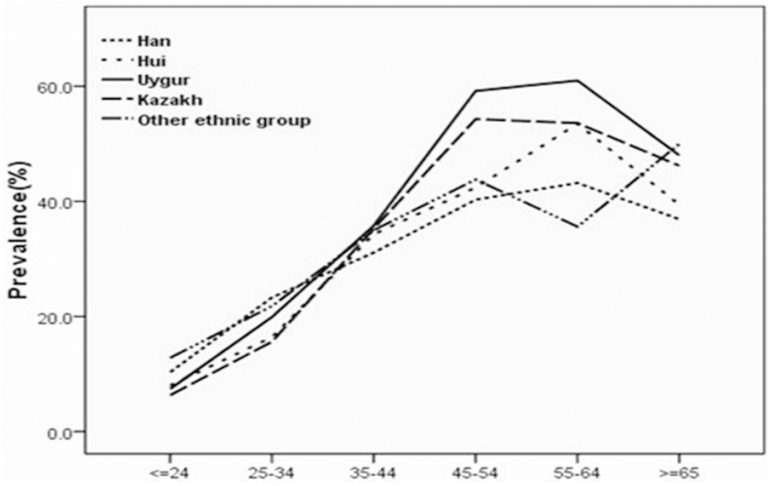

Figure 2. Prevalence of FLD in different ethnicity by age groups.

group were 32.0%, 31.2%, 31.5%, 39.3%, 36.4% and 32.8%, respectively. The prevalence of FLD in male and female were 41.3% and 20.3%.

According to different ethnicity, male and female prevalence of FLD were 40.6% and 19.0% in Han, 41.6% and 20.7% in Hui, 48.3% and 29.7% in Uygur, 45.3% and 25.1% in Kazakh, 38.4% and 27.2% in other ethnic group, respectively. The prevalence of FLD in various ethnicity were significantly different (P < 0.01), in Uygur was higher than the other ethnicity and in Han was the lowest among Hui, Uygur and Kazakh, the same phenomenon was observed in both male and female. In each ethnic group, the prevalence of FLD in male was significantly higher than female (P < 0.01).

According to different age groups and gender, all subjects were divided into six groups showed in **Figure 1**. The prevalence of FLD among various age groups were significantly different in total (χ^2 = 2929.39, P < 0.01), as well as in both male (χ^2 = 1610.68, P < 0.01) and female (χ^2 = 3296.68, P < 0.01). The peak prevalence of FLD in total was 45.1% presenting in subjects aged of 55~64 years, in male was 51.9% presenting in subjects aged 45~54 years. In female, the prevalence increased with age. In each age group, the prevalence of FLD in male was significantly higher than female (P < 0.01), but in subjects aged of 55~64 years, there were similar in male and female (χ^2 = 1.42, P = 0.23), furthermore, over 65 years of age, the prevalence of FLD in female was significantly higher than male (χ^2 = 88.80, P < 0.01).

The prevalence of FLD in different ethnicity by age groups were illustrated. AS showed in **Figure 2**, the peak prevalence of FLD presented in subjects aged of 55~64 years except Kazakh presenting in group aged of 45~54 years and other ethnic group presenting in group aged over 65 years. It displayed a tendency that the prevalence of FLD was increased with ages and reduced after the presence of the peak prevalence of FLD in Han, Hui, Uygur and Kazakh. The prevalence was higher in Uygur than that Han, Hui, and Kazakh among population older than 35 years.

Distribution characteristics of dysmetabolic diseases in different ethnic subjects diagnosed with FLD

As showed in **Table 3**, there were significantly different of the prevalence of dysmetabolic diseases in different ethnic groups with FLD. The

Table 3. Prevalence of dysmetabolic diseases and abnormal biochemical indicators in FLD by ethnicity

Characteristics	Total n (%)	Han n (%)	Hui n (%)	Uygur n (%)	Kazakh n (%)	Other ethnic group n (%)	χ^2 value	*P* value
Hypertension	4210 (28.2)	3485 (28.6)	193 (29.2)	385 (23.6)	111 (34.8)	36 (29.8)	24.97	< 0.01
DM	2291 (15.4)	1847 (15.1)	124 (18.8)	265 (16.3)	46 (14.4)	9 (7.4)	13.50	< 0.01
Overweight	6740 (67.6)	5770 (67.6)	293 (67.5)	543 (68.0)	92 (66.2)	42 (58.3)	3.02	0.55
Obesity	4951 (60.5)	3665 (57.0)	226 (61.6)	831 (76.5)	180 (79.3)	49 (62.0)	182.72	< 0.01
Dyslipidemia	12609 (84.5)	10367 (85.0)	549 (83.2)	1356 (83.2)	248 (77.7)	89 (73.6)	27.37	< 0.01
Hypertriglyceridemia	9510 (61.3)	7601 (62.3)	403 (61.1)	934 (57.3)	152 (47.6)	60 (49.6)	48.25	< 0.01
Hypercholesteremia	3279 (22.0)	2625 (21.5)	145 (22.0)	393 (24.1)	93 (29.2)	23 (19.0)	16.05	< 0.01
Low HDL-C	6737 (45.1)	5569 (45.7)	303 (45.9)	718 (44.1)	107 (33.5)	40 (33.1)	26.71	< 0.01
High LDL-C	6452 (43.2)	5182 (42.5)	288 (43.6)	767 (47.1)	167 (52.4)	48 (39.7)	24.07	< 0.01

Table 4. Univariate analysis of associative risk factors for FLD by ethnicity

Characteristics by ethnicity	Case (n)	FLD n (%)	χ^2 value	*P* value	OR (95% CI)
Han	39120	12196 (31.2)	-	-	-
Hypertension	6404	3485 (54.4)	1928.08	< 0.01	3.29 (3.11~3.48)
DM	2965	1847 (62.3)	1447.79	< 0.01	4.12 (3.81~4.45)
Dyslipidemia	24517	10367 (42.3)	3777.64	< 0.01	5.12 (4.84~5.41)
Overweight	13036	5770 (44.3)	4235.64	< 0.01	5.33 (5.05~5.62)
Obesity	4896	3665 (76.3)	8456.35	< 0.01	21.54 (19.94~23.28)
Hui	2098	660 (31.5)	-	-	-
Hypertension	333	193 (58.0)	28.91	< 0.01	3.83 (3.01~4.88)
DM	193	124 (64.2)	105.99	< 0.01	4.59 (3.36~6.26)
Dyslipidemia	1248	549 (44.0)	224.36	< 0.01	5.23 (4.16~6.57)
Overweight	674	293 (43.5)	219.14	< 0.01	5.35 (4.23~6.75)
Obesity	303	226 (74.6)	479.44	< 0.01	20.40 (14.92~27.90)
Uygur	4148	1629 (39.3)		-	-
Hypertension	597	385 (64.5)	185.94	< 0.01	3.37 (2.81~4.04)
DM	353	265 (75.1)	207.33	< 0.01	5.37 (4.18~6.89)
Dyslipidemia	2747	1356 (49.4)	347.26	< 0.01	4.03 (3.46~4.69)
Overweight	1305	543 (41.6)	278.93	< 0.01	4.14 (3.48~4.92)
Obesity	1107	831 (75.1)	1043.86	< 0.01	17.49 (14.56~21.15)
Kazakh	877	319 (36.4)	-	-	-
Hypertension	181	111 (61.3)	61.36	< 0.01	3.72 (2.65~5.23)
DM	65	46 (70.8)	35.89	< 0.01	4.78 (2.75~8.32)
Dyslipidemia	519	248 (47.8)	71.52	< 0.01	3.70 (2.71~5.05)
Overweight	237	92 (38.8)	58.78	< 0.01	4.51 (3.02~6.74)
Obesity	259	180 (69.5)	220.11	< 0.01	16.19 (10.81~24.25)
Other ethnic group	369	121 (32.8)	-	-	-
Hypertension	59	36 (61.0)	25.39	< 0.01	4.14 (2.32~7.40)
DM	12	9 (75.0)	10.03	< 0.01	6.56 (1.74~24.71)
Dyslipidemia	201	89 (44.3)	26.43	< 0.01	3.38 (2.1~5.43)
Overweight	119	42 (35.3)	14.78	< 0.01	2.84 (1.65~4.88)
Obesity	64	49 (76.6)	80.46	< 0.01	16.99 (8.45~34.14)

prevalence of dyslipidemia and hypertriglyceridemia were higher in Han than the other ethnicity ($P < 0.01$). The prevalence of DM in Hui was higher than the other ethnicity ($P < 0.01$). In

Table 5. Multiple logistic regression analysis of risk factors for FLD by ethnicity

Variables by ethnicity	β	SE	Wald χ^2 value	*P* value	OR	95% CI
Han						
Age groups	-	-	383.33	< 0.01	-	-
≤ 24	-	-	-	-	1 (Reference)	-
25~34	0.63	0.07	82.65	< 0.01	1.88	1.64~2.15
35~44	0.88	0.07	167.03	< 0.01	2.40	2.10~2.74
45~54	1.13	0.07	267.46	< 0.01	3.09	2.70~3.54
55~64	1.11	0.07	225.43	< 0.01	3.04	2.63~3.52
≥ 65	0.92	0.08	96.56	< 0.01	2.16	1.85~2.52
Male	0.43	0.03	223.26	< 0.01	1.53	1.45~1.62
Hypertension	0.32	0.03	89.52	< 0.01	1.38	1.29~1.48
DM	0.87	0.05	346.47	< 0.01	2.38	2.17~2.60
Dyslipidemia	1.06	0.03	1111.55	< 0.01	2.88	2.71~3.07
Classifying BMI	-	-	4241.30	< 0.01	-	-
BMI < 23.0 kg/m^2	-	-	-	-	1 (Reference)	-
Overweight	1.28	0.03	1943.00	< 0.01	3.60	3.40~3.82
Obesity	2.62	0.04	3822.28	< 0.01	13.67	12.58~14.85
Hui						
Age groups	-	-	45.20	< 0.01	-	-
≤ 24	-	-	-	-	1 (Reference)	-
25~34	0.51	0.32	2.58	0.11	1.67	0.89~3.12
35~44	1.16	0.32	13.52	< 0.01	3.19	1.72~5.91
45~54	1.32	0.32	17.29	< 0.01	3.76	2.01~7.01
55~64	1.47	0.33	19.66	< 0.01	4.34	2.27~8.30
≥ 65	0.80	0.37	4.73	0.03	2.22	1.08~4.56
Male	0.39	0.12	10.28	< 0.01	1.48	1.16~1.88
Hypertension	0.40	0.15	6.93	< 0.01	1.49	1.11~2.00
DM	0.86	0.19	20.18	< 0.01	2.35	1.62~3.41
Dyslipidemia	1.06	0.14	60.93	< 0.01	2.87	2.20~3.74
Classifying BMI	-	-	210.77	< 0.01	-	-
BMI < 23.0 kg/m^2	-	-	-	-	1 (Reference)	-
Overweight	1.23	0.13	90.06	< 0.01	3.43	2.66~4.42
Obesity	2.44	0.17	196.41	< 0.01	11.44	8.13~16.08
Uygur						
Age groups	-	-	145.42	< 0.01	-	-
≤ 24	-	-	-	-	1 (Reference)	-
25~34	0.79	0.27	8.38	< 0.01	2.21	1.29~3.77
35~44	1.30	0.27	23.69	< 0.01	3.66	2.17~6.17
45~54	2.02	0.27	55.96	< 0.01	7.55	4.45~12.83
55~64	1.74	0.29	36.51	< 0.01	5.70	3.24~10.02
≥ 65	1.31	0.31	17.67	< 0.01	3.69	2.01~6.79
Male	0.30	0.08	13.20	< 0.01	1.35	1.15~1.59
Hypertension	0.09	0.12	067	0.41	1.10	0.88~1.38
DM	0.99	0.15	43.08	< 0.01	2.70	2.01~3.62
Dyslipidemia	0.74	0.09	64.20	< 0.01	2.10	1.75~2.52
Classifying BMI	-	-	527.49	< 0.01	-	-
BMI < 23.0 kg/m^2	-	-	-	-	1 (Reference)	-
Overweight	1.08	0.10	130.63	< 0.01	2.96	2.46~3.56

Obesity	2.41	0.11	525.78	< 0.01	11.14	9.07~13.69
Kazakh						
Age groups	-	-	27.53	< 0.01	-	-
≤ 24	-	-	-	-	1 (Reference)	-
25~34	0.76	0.54	1.97	0.16	2.14	0.74~6.17
35~44	1.43	0.52	7.50	< 0.01	4.17	1.50~11.60
45~54	1.94	0.52	13.78	< 0.01	6.96	2.50~19.39
55~64	1.77	0.56	10.05	< 0.01	5.87	1.97~17.53
≥ 65	1.63	0.60	7.47	< 0.01	5.09	1.59~16.34
Male	0.40	0.18	4.87	0.03	1.50	1.05~2.15
Hypertension	0.09	0.22	0.18	0.67	1.10	0.72~1.68
DM	0.66	0.33	4.01	0.04	1.93	1.01~3.68
Dyslipidemia	0.54	0.20	7.64	< 0.01	1.71	1.17~2.51
Classifying BMI	-	-	102.04	< 0.01	-	-
BMI < 23.0 kg/m^2	-	-	-	-	1 (Reference)	-
Overweight	1.19	0.22	29.37	< 0.01	3.29	2.15~5.05
Obesity	2.28	0.23	101.81	< 0.01	9.75	6.27~15.18
Other ethnic group						
Age groups	-	-	9.80	0.08	-	-
≤ 24	-	-	-	-	1 (Reference)	-
25~34	0.03	0.60	0.003	0.96	1.04	0.32~3.36
35~44	0.73	0.60	1.51	0.22	2.09	0.64~6.78
45~54	0.72	0.60	1.42	0.23	2.04	0.63~6.62
55~64	-0.47	0.70	0.46	0.50	0.62	0.16~2.47
≥ 65	0.50	0.86	0.34	0.56	1.65	0.31~8.83
Male	0.01	0.29	0.001	0.97	1.01	0.58~1.77
Hypertension	0.61	0.37	2.69	0.10	1.84	0.89~3.80
DM	1.94	0.80	5.93	0.02	6.93	1.46~32.91
Dyslipidemia	1.07	0.30	12.64	< 0.01	2.91	1.61~5.24
Classifying BMI	-	-	44.93	< 0.01	-	-
BMI < 23.0 kg/m^2	-	-	-	-	1 (Reference)	-
Overweight	0.96	0.31	9.44	< 0.01	2.61	1.42~4.82
Obesity	2.70	0.40	44.93	< 0.01	14.84	6.74~32.65

Han and Hui, the prevalence of low HDL-C was higher than the other groups (P < 0.01). The prevalence of hypertension, Hypercholesteremia and high LDL-C were higher in Kazakh than the other groups (P < 0.01). In Uygur and Kazakh, the prevalence of obesity was higher than the other groups (P < 0.01). In all groups, it was no different of the prevalence of overweight (P = 0.55). In all subjects diagnosed with FLD, it was 84.5% that the prevalence of dyslipidemia was the highest among the other dysmetabolic diseases.

Association of risk factors with FLD

The following variables were analyzed for the presence of FLD by ethnicity, including hypertension, DM, dyslipidemia, overweight and obesity. For these variables, OR and 95% CI were calculated.

The findings of unvariate analysis of associative risk factors for FLD were presented in **Table 4**. The variables analyzed above were highly significantly associated with the presence of FLD in each ethnic group (P < 0.01). Of these variables, OR with 95% CI for obesity was the highest, they were 21.54 (19.94~23.28) in Han, 20.40 (14.92~27.90) in Hui, 17.49 (14.56~21.15) in Uygur, 16.19 (10.81~24.25) in Kazakh and 16.99 (8.45~34.14) in other ethnic group, respectively. The others were showed in **Table 4**. Multiple logistic regression

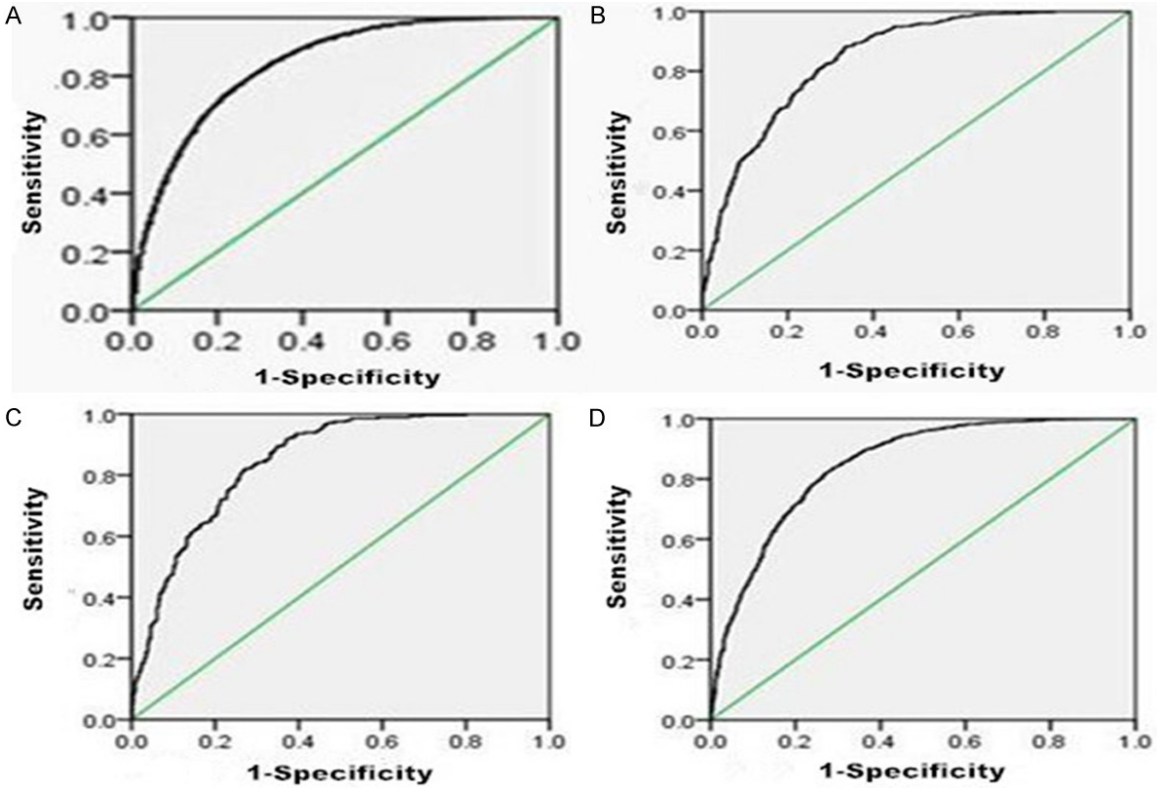

Figure 3. The ROC curves for BMI. A: Han; B: Hui; C: Uygur; D: Kazakh.

analysis by ethnicity was conducted. As showed in **Table 5**, the variables including male, age, hypertension, DM, dyslipidemia, overweight and obesity were closely related to FLD in Han and Hui ($P < 0.01$). In Uygur and Kazakh, variables including male, age, DM, dyslipidemia, overweight and obesity were closely related to FLD ($P < 0.05$). In other ethnic group, DM, dyslipidemia, overweight and obesity were found to be effective on FLD ($P < 0.05$). OR adjusted with 95% CI were indicated in table 5. OR adjusted for obesity were higher in various ethnic group, they were 13.67, 11.44, 11.14, 9.75 and 14.84 in Han, Hui, Uygur, Kazakh and other ethnic group, respectively.

In **Figure 3**, the receiver operating characteristic (ROC) curve analysis was conducted. BMI used to gauge obesity was used as the screening factors of FLD. The AUC with 95% CI in Han, Hui, Uygur and Kazakh were 0.842 (0.838~0.846), 0.846 (0.828~0.863), 0.848 (0.835~0.860) and 0.848 (0.821~0.875), respectively, compared with 0.5, there were significantly different ($P < 0.01$). Sensitivity and specificity were 0.806 and 0.713 (Han), 0.880 and 0.666 (Hui), 0.837 and 0.711 (Uygur), 0.896 and 0.646 (Kazakh). The cut-off value were 24.5, 24.2, 25.6 and 25.6 in Han, Hui, Uygur and Kazakh, respectively.

Discussion

Fatty liver disease easily caused by various adverse factors and sicknesses is a clinicopathologic syndrome, which is characterized by excess accumulation of lipid in hepatocytes [24]. With ultrasonography detecting FLD had been applied in China since the 1990s [25], the prevalence of FLD ranged widely from 1% to 50% on account of investigations being in different time and geographic locality, respondents having different demographic characteristics and different diagnostic criteria [26]. In our survey, we revealed a relatively high prevalence of FLD in public servants of Urumqi who underwent annual physical check-up. Our findings indicated that the prevalence were 32.0% of total, 31.2% of Han, 31.5% of Hui, 39.3% of Uygur, 36.4% of Kazakh and 32.8% of other ethnic group. Comparing with several previous surveys mainly recruiting general Chinese Han

population [7-11, 16], our result was slightly less than 35.1% of Beijing investigating in 2005 and much more than the other cities. Concerning on the prevalence of FLD in the minorities of China, the data was limited. A survey [17] reported that the prevalence of FLD in Han and Uygur were higher than our findings, but this study recruited health check-up population with small samples which can not represent general population.

Public servants who frequently bear heavy work tasks and interpersonal stress possess more adverse lifestyle and eating habits, such as long time operating computers and sedentariness, fewer physical exercise, simple or having no breakfast and smoking or excessive drinking [18], which can lead to sub-health and various diseases. Above reasons could contribute to the high prevalence of FLD in public servants. Further to stratify by age, we noticed that the prevalence of FLD exceeded 30% over 35years old groups in each ethnic group, in addition, the prevalence slow declined after reaching the peak mainly presenting between 55 and 64 years, while, the tendency did not exist in other ethnic group which peak presenting in over 65 years groups including small sample and the prevalence was bias. Public servants who generally have advanced education have high health awareness, after retiring, they can spend more time to take care of healthcare and not have stress of work. So the prevalence is down in population aged over 65 years.

Simultaneously, our survey showed that the prevalence of FLD was higher in Uygur than the other ethnic groups, and was lower in Han and Hui than the other ethnic groups regardless of male or female. We also acquired the significant difference for the prevalence of FLD among the subgroups classified by age and ethnicity. The prevalence was higher in Uygur than that in the other ethnic groups and was lower in Han and Hui among public servants older than 35 years, while, between 25 and 34 years, it was high to Han public servants. The mechanism of this ethnic diversity is less know. Association of gene polymorphism with FLD were reported in different ethnicity [27-29], although studies regarding to minority of Xinjiang in this field are rare, it notes that the genetic profile possibly contribute to ethnic predilection. Certainly lifestyle and dietary habit cannot be neglected. Though, among Han, Hui, Uygur and Kazakh, there are partly overlap in food intake, their own dietary habit is distinct, the Huis consume more potatoes and vegetable oil, the Uyghurs eating more animal fat and high protein diet, whereas the Kazaks intake a high-salt diet [30]. Also, compared with the other ethnicity [31], Uygur is more likely to have abdominal obesity which is strongly correlated with intra-hepatic fat [14]. These above factors could lead to the ethnic difference, further studies are required to reveal the mechanism.

In our study, the prevalence of FLD in male was significantly higher than female regardless of ethnicity, and that only existed in blew the 54-year-old population, it was reversed in over the-65-year-old population. The peak prevalence in male presented in population aged between 45 to 54 years. In female, the prevalence was increased with age. The similar phenomenon was observed in previous surveys [7-11]. This difference between male and female can be due to changes in estrogen levels. After perimenopause or menopause in female, estrogen levels began to down which suppress visceral fat accumulation and to increase subcutaneous fat accumulation. Hence, Menopausal female markedly present the enhancive visceral fat which increasing the prevalence of FLD [32]. These remind us that more preventive strategies should be implemented for the high risk population.

In China, the main risk factors for FLD including central obesity, obesity, dyslipidemia, T2D, insulin resistance, and MetS, which are similar in the developed country [26]. Previous study showed that there were no differences in the risk factors of FLD among ethnicities [14], but there are few resemblant reports among minorities of Xinjiang. We observed the prevalence of dysmetabolic diseases in FLD among ethnicity. Our findings showed that the prevalence of dyslipidemia, hypertriglyceridemia, overweight and obesity in subjects diagnose FLD were high among different ethnicity. It indicated the comorbidity rate of these diseases were common. Distributions of these diseases also were different in various ethnic groups. Our multivariate regression analyses showed that there were similar risk factors of FLD including hyperlipidemia, DM, overweight and obesity among different ethnicity, but hypertension was not the risk factor of FLD in Uygur, Kazakh and other ethnic group, and in other ethnic group,

male and age were not the risk factors. The reasons concerning on these differences are unclear, the different gene background and disease spectrum among various ethnicity may contribute to the differences .Our previous findings indicated that obesity having higher OR value closely correlative with FLD. So we conducted ROC analysis. Results suggested BMI could be acceptable as predictive index of FLD, and different ethnic group cut-off value were distinct.

In the present investigation, there have been several limitations. Firstly, our survey was a cross-sectional study, possible recall bias may limit our findings.

Secondly, potential risk factors such as waist circumference, alcohol consumption, physical inactivity and sedentary lifestyle were absent which may hinder our attempts to further realize correlation between these risk factors and FLD. Finally, our study was conducted in specific geographical region with certain population which limited generalization of our findings.

Conclusion

In summary, our findings indicate that the high prevalence of FLD is present among public servants in Urumqi of Xinjiang, China. The prevalence of FLD is significantly different in different ethnic groups and genders. Age, gender, DM, obesity, dyslipidemia and hypertension are closely related to FLD. Distribution of these correlative factors are disparate in different ethnicity. Comprehensive strategies for the prevention and treatment of FLD should be explored basing on the ethnic differences.

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Disclosure of conflict of interest

None.

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