Analysis of the Prevalence and Influencing Factors of Fatty Liver among Employees of a Power Plant in Wuhu City

Zhang LianHua[1][iD][*]

[1]*Employee Health Management Center, Wuhu Electricity Generating Limited Liability Company, Anhui, China*

Corresponding Author: **Zhang LianHua** [ORCID iD]

Address: Employee Health Management Center, Wuhu Electricity Generating Limited Liability Company, Sanshan District, Wuhu City, Anhui Province, China, 241000; Email:13866386240@163.com

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Abstract

Objective: To understand the prevalence rate of fatty liver among employees of a power plant in Wuhu City and analyze its influencing factors.

Methods: The health examination results of 1,818 employees of a power plant in Wuhu City with complete data in 2015 were collected and statistically analyzed.

Results: A total of 691 cases of fatty liver were detected with a prevalence rate of 38.01%. Among them, there were 499 male cases with a prevalence rate of 43.77%. There were 192 female cases with a prevalence rate of 28.32%. There was a statistically significant comparison of the prevalence of fatty liver between men and women ($p<0.01$). The prevalence of fatty liver in men is 1.55 times that in women. The prevalence of fatty liver increases with age ($p<0.01$). The prevalence of fatty liver in men before the age of 60 was significantly higher than that in women ($p<0.01$). The prevalence of fatty liver in women was higher than that in men after the age of 60 ($p>0.05$). The prevalence rates of overweight and obesity, hyperglycemia, hypertension, hyperlipidemia, hyperuricemia, gallbladder diseases, and abnormal liver function in the fatty liver group were significantly higher than those in the non-fatty liver group ($p<0.01$). The prevalence of abnormal electrocardiogram in the fatty liver group was significantly lower than that in the non-fatty liver group ($p<0.01$). The levels of age, body mass index (BMI), fasting blood glucose (FBG), systolic blood pressure (SBP), diastolic blood pressure (DBP), total cholesterol (TC), triglycerides (TG), low-density lipoprotein cholesterol (LDL-C), and uric acid (UA) in the fatty liver group were significantly higher than those in the non-fatty liver group ($p<0.05$). The high-density lipoprotein cholesterol (HDL-C) in the fatty liver group was significantly lower than that in the non-fatty liver group ($p<0.001$).

Conclusion: The prevalence of fatty liver among employees in a power plant in Wuhu City is relatively high. Body mass index, blood lipid, blood pressure, blood sugar, and blood uric acid levels are closely related to the occurrence of fatty liver. Losing weight, controlling high blood lipid, and maintaining normal blood sugar, blood pressure, and blood uric acid levels are important measures for the prevention and treatment of fatty liver.

Keywords

Fatty Liver, Prevalence, Body Mass Index, Metabolic Risk Factors, Hypertension

Abbreviations

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BMI: Body Mass Index; SBP: Systolic Blood Pressure; DBP: Diastolic Blood Pressure; LDL-C: Low-density Lipoprotein Cholesterol; HDL-C: High-density Lipoprotein Cholesterol; Glu: Glucose; TC: Total Cholesterol; TG: Triglyceride; UA: Uric Acid

With the rapid economic development and the improvement of living standards, people's dietary structure and lifestyle have undergone tremendous changes. The prevalence rate of fatty liver is constantly increasing. Fatty liver has become one of the global public health problems and is also the most common cause of chronic liver diseases. Fatty liver is reversible. After changing lifestyle and dietary habits, it can mostly return to normal. However, if not diagnosed early and intervened in time, it may develop into liver cirrhosis or even liver cancer. Therefore, the early detection, early diagnosis, early prevention and early treatment of fatty liver are important means to improve the health conditions of employees. This article aims to study the prevalence rate of fatty liver among employees of a power plant in Wuhu City and its influencing factors, providing a theoretical basis for the prevention and treatment of fatty liver.

Objects and Methods

Objects:

A random sampling method was adopted to select 1,818 employees of a certain company in Wuhu as the research subjects. Among the study subjects, the age ranged from 21 to 93 years old with an average age of (50.62 ± 13.91) years. There were 1,140 males (62.71%) and 678 females (37.29%), among which the average age of males was (49.96 ± 14.38) years and that of females was (51.75 ± 13.01) years. There was a statistically significant difference in age between men and women ($p<0.01$). The research subjects included 63 cases under 30 years old (3.47%), 311 cases aged 30 to 39 years old (17.11%), 673 cases aged 40 to 49 years old (37.02%), 310 cases aged 50 to 59 years old (17.05%), and 461 cases over 60 years old (25.36%).

Methods:

In 2015, the height, body weight and blood pressure of all the research subjects were measured. At the same time, empty abdominal resting pulse blood was drawn for blood lipid, blood glucose and uric acid liver function tests. Collect the diagnostic results of B-ultrasound for fatty liver and gallbladder diseases. Collect the diagnostic results of abnormal electrocardiograms. And the obtained data were statistically analyzed.

Diagnostic Criteria:

Diagnostic Criteria for Diabetes:

According to the diagnostic criteria in the "Chinese Guidelines for the Prevention and Treatment of Type 2 Diabetes Mellitus (2020 Edition) (Part 1)" [1], diabetes is diagnosed with typical symptoms of diabetes along with a random blood glucose ≥11.1 mmol/L, or a fasting blood glucose ≥7.0 mmol/L, or an OGTT 2-hour venous blood glucose ≥11.1 mmol/L, or an HbA1c ≥6.5%.

Diagnostic Criteria for Hypertension:

According to the diagnostic criteria in the "Chinese Hypertension Prevention and Treatment Guidelines (Revised Edition 2024)" [2], individuals with normal blood pressure who have a systolic blood pressure (SBP) of ≥140 mmHg (1 mmHg = 0.133 kPa) and/or a diastolic blood pressure (DBP) of ≥90 mmHg or have taken antihypertensive drugs in the past two weeks are defined as having hypertension.

Diagnostic Criteria for Hyperlipidemia:

According to the "Guidelines for the Prevention and Treatment of Dyslipidemia in Chinese Adults (Revised Edition 2016)" [3], the diagnostic criteria were total cholesterol ≥5.2 mmol/L and/or triglycerides ≥1.7 mmol/L and/or high-density lipoprotein cholesterol ≤1.0 mmol/L and/or low-density lipoprotein cholesterol ≥3.4 mmol/L.

Diagnostic Criteria for Overweight and Obesity:

According to the "Expert Consensus on Medical Nutritional Therapy for Overweight/Obesity in China (2016 Edition)" [4], BMI<18.5 kg/m² is considered underweight, 18.5 kg/m²≦BMI<24.0 kg/m² is considered normal, 24.0 kg/m²≦BMI<28.0 kg/m² is considered overweight, and BMI≧28.0 kg/m² is considered obesity.

Diagnostic Criteria for Hyperuricemia:

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According to the "Dietary Guidelines for Adult Hyperuricemia and Gout" [5], under normal dietary conditions, the fasting blood uric acid level should be tested twice on different days and hyperuricemia can be diagnosed at 420 μmol/L.

The diagnosis of fatty liver and gallbladder diseases is based on the results of B-ultrasound diagnosis during physical examination.

Abnormal electrocardiogram and liver function shall be based on the diagnosis results of physical examination.

Statistical Methods:

All data were statistically analyzed using SPSS 17.0 software. Measurement data were analyzed by t-test, and count data were analyzed by χ^2 test. A p value <0.05 was considered statistically significant.

Result

Comparison of the Prevalence Rate of Fatty Liver among Different Genders and Age Groups:

Among the 1,818 health examination results with complete data in 2015, 691 cases of fatty liver were detected with a prevalence rate of 38.01%. Among them, 499 cases were male with a prevalence rate of 43.77%. There were 192 female cases with a prevalence rate of 28.32%. The comparison of the prevalence rates between men and women was statistically significant (p<0.01). The prevalence rate of fatty liver in men is 1.55 times that in women. The prevalence rate of fatty liver in men before the age of 60 was higher than that in women and the difference was statistically significant (p<0.01). The prevalence rate of fatty liver in women after the age of 60 was higher than that in men, but the difference was not statistically significant (p>0.05). The prevalence rate of fatty liver increases with age and the difference is statistically significant (χ^2=21.804, p<0.01). The prevalence rate of fatty liver among employees aged 50 to 59 reached the highest value of 44.19%. The prevalence rate of fatty liver among male employees reached the highest value of 50.00% among those aged 50 to 59, while that among female employees reached the highest value of 45.45% among those aged 60 or above (**Table-1**).

Table-1: Comparison of the prevalence rate of fatty liver in different genders and age groups n(%)

Age (years)	Male (1140)		Female (678)		Total (1818)		χ^2	P
	Case	Prevalence n (%)	Case	Prevalence n (%)	Case	Prevalence n (%)		
<30	55	9 (16.36)	8	0	63	9 (14.29)	1.527	>0.05
30−39	220	101 (45.91)	91	11 (12.09)	311	112 (36.01)	31.946	<0.01
40−49	402	195 (48.51)	271	53 (19.56)	673	248 (36.85)	58.253	<0.01
50−59	178	89 (50.00)	132	48 (36.36)	310	137 (44.19)	5.479	<0.05
≥60	285	105 (36.84)	176	80 (45.45)	461	185 (40.13)	3.376	>0.05
Total	1140	499 (43.77)	678	192 (28.32)	1818	691 (38.01)	42.762	<0.01

Table-2: Comparison of prevalence rate of the same diseases between the fatty liver group and the non-fatty liver group n(%)

Project	Fatty liver group (691)		Non-fatty liver group (1127)		χ^2	P
	Case	n (%)	Case	n (%)		
Overweight and obesity	582	84.23	344	30.52	493.454	<0.01
Hyperglycemia	186	26.92	135	11.98	64.943	<0.01
Hypertension	409	59.19	395	35.05	107.67	<0.01
Hyperlipidemia	314	45.44	279	24.76	82.734	<0.01
Hyperuricemia	162	23.44	93	8.25	82.156	<0.01
Gallbladder diseases	194	28.08	243	21.56	9.665	<0.01
Abnormal liver function	242	35.02	141	12.51	130.751	<0.01
Abnormal electrocardiogram	176	25.47	367	32.56	10.598	<0.01

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Table-3: Comparison of various factors between the fatty liver group and the non-fatty liver group (x̄ ± S)

Project	Fatty liver group	Non-fatty liver group	t	p
Age (years)	51.46 ± 12.96	50.11 ± 14.44	2.158	<0.05
BMI (kg/m²)	26.54 ± 2.74	22.82 ± 2.72	30.492	<0.001
FBG (mmol/L)	5.98 ± 1.53	5.49 ± 0.96	8.727	<0.001
SBP (mmHg)	137.38 ± 17.88	127.86 ± 18.42	11.656	<0.001
DBP (mmHg)	85.68 ± 12.33	78.35 ± 12.27	13.327	<0.001
TC (mmol/L)	5.21 ± 0.94	4.92 ± 0.93	6.444	<0.001
TG (mmol/L)	2.01 ± 1.22	1.24 ± 0.83	17.111	<0.001
HDL-C (mmol/L)	1.29 ± 0.41	1.52 ± 0.37	13.529	<0.001
LDL-C (mmol/L)	3.03 ± 0.70	2.71 ± 0.71	10.127	<0.001
UA (µmol/L)	360.60 ± 81.77	303.11 ± 77.54	16.325	<0.001

Comparison of The Prevalence Rate of the Same Disease Between the Fatty Liver Group and The Non-Fatty Liver Group:

The prevalence of fatty liver combined with overweight and obesity, hyperglycemia, hypertension, hyperlipidemia, hyperuricemia, gallbladder disease, and abnormal liver function was significantly higher than that of the non-fatty liver group, and the difference was statistically significant (p<0.01). The prevalence of fatty liver combined with abnormal electrocardiogram was significantly lower than that of the non-fatty liver group, and the difference was statistically significant (p<0.01) (**Table-2**).

Comparison of Various Factors Between the Fatty Liver Group and The Non-Fatty Liver Group:

There was a statistically significant difference in age between the fatty liver group and the non-fatty liver group (p<0.05). The levels of body mass index (BMI), fasting blood glucose (FBG), systolic blood pressure (SBP), diastolic blood pressure (DBP), total cholesterol (TC), triglycerides (TG), low-density lipoprotein cholesterol (LDL-C), and uric acid (UA) in the fatty liver group were significantly higher than those in the non-fatty liver group, and the differences were statistically significant (p<0.001). The level of high-density lipoprotein cholesterol (HDL-C) in the fatty liver group was significantly lower than that in the non-fatty liver group, and the difference was statistically significant (p<0.001) (**Table-3**).

Discussion

Fatty liver refers to a lesion where excessive fat accumulates within liver cells due to various reasons. In a normal liver, fat accounts for 3% to 4% of the liver weight. If the fat content exceeds 5% of the liver weight or if more than one-third of the liver cells have fatty changes per unit area histologically, it is called fatty liver. Fatty liver is a pathological state caused by excessive fat deposition in liver tissue due to multiple factors. With the improvement of living standards, the prevalence rate of fatty liver is on the rise and has become the leading cause of liver diseases. It is also one of the common chronic non-communicable diseases [6]. In addition, fatty liver has the risk of developing into liver cirrhosis, liver cancer, and liver failure. Therefore, epidemiological studies on fatty liver have received widespread attention.

The prevalence rate of fatty liver among the staff of Wuhu Electric Power Company studied in this article is 38.01%. It is higher than the report by Hu Conghui et al. that the prevalence rate of fatty liver among adults in Xinshi District, Urumqi City in 2020 was 15.79% [6]. And it is higher than the report by Li Huixia et al. that the prevalence rate of NAFLD in Honghe Prefecture, Yunnan Province was 20.5% [7]. It is higher than the report of 21.22% prevalence rate of fatty liver among the physical examination population of a certain unit in Luzhou City by Wang Lu et al. [8]. And it is higher than the report of 21.84% prevalence rate of fatty liver among the physical examination population in Kunming City by Yan Lei et al. [9]. It is lower than the report by Yao Yinghua et al. that the prevalence rate of fatty liver among the physical examination population in Shantou City was 47% [10]. The prevalence rate of

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fatty liver in men (43.77%) was higher than that in women (28.31%) (p<0.01), which was consistent with the study by Yan Lei et al. [9]. The prevalence rate of fatty liver in men is 1.55 times that of women, which is less than the report by Wang Lu et al. that the prevalence rate of fatty liver in men is approximately three times that in women [8].

The prevalence rate of fatty liver in men before the age of 60 was higher than that in women, and the difference was statistically significant (p<0.01). The prevalence rate of fatty liver in women was higher than that in men after the age of 60 (p>0.05). It is consistent with the research of Deng Jiang, Tong Cong, et al. [11,12]. The age range of 30 to 59 is the high-incidence period for fatty liver in men, and the prevalence rate significantly decreases after the age of 60. Because men aged 30 to 59 are at the peak of their careers, they are busy with work and have many social engagements. They do not pay enough attention to their health and do not have more time to take part in physical exercise. After the age of 60, social activities significantly decrease. Additionally, there is time for physical exercise, and the prevalence rate of fatty liver gradually declines. The prevalence rate of fatty liver in women increases with age, reaching its peak at 45.45% after the age of 60. Female employees over 60 years old are mostly in menopause. At this time, the level of estrogen drops, leading to hormonal metabolism disorders and abnormal lipid metabolism in the body, which causes obesity, diabetes, and fatty liver. This is consistent with the research results on the current situation investigation and risk factor analysis of fatty liver conducted by Wang Yanren at a certain physical examination center in Hangzhou [13].

The prevalence rate of fatty liver combined with overweight and obesity, hyperglycemia, hypertension, hyperlipidemia, hyperuricemia, gallbladder disease, and abnormal liver function was significantly higher than that of the non-fatty liver group (p<0.01). The levels of body mass index (BMI), fasting blood glucose (FBG), systolic blood pressure (SBP), diastolic blood pressure (DBP), total cholesterol (TC), triglycerides (TG), LDL-C and uric acid (UA) in the fatty liver group were significantly higher than those in the non-fatty liver group (p<0.01), indicating that body mass index (BMI), blood lipid, blood pressure, blood glucose and blood uric acid levels were closely related to the occurrence of fatty liver, which was consistent with previous reports [6,14,8,9,12,13]. The prevalence rate of fatty liver combined with abnormal electrocardiogram was significantly lower than that of the non-fatty liver group (p<0.01), which is different from the study by Qin Li et al. [15] that non-alcoholic fatty liver disease is a risk factor for cardiovascular diseases. This may be related to the fact that the subjects of this study were healthy people undergoing physical examinations, or it may be related to the smaller sample size of this study. The age of the fatty liver group was greater than that of the non-fatty liver group (p<0.05), indicating that age is a risk factor for fatty liver. With the increase of age, the metabolic rate of the human body decreases significantly. Coupled with the lack of exercise, the prevalence rate of fatty liver will also gradually increase.

Conclusion

In conclusion, the prevalence of fatty liver among the staff of Wuhu Electric Power Plant is relatively high. Body mass index (BMI), blood lipid, blood pressure, blood sugar and blood uric acid levels are closely related to the occurrence of fatty liver. Therefore, actively carrying out health promotion and education for employees, controlling blood sugar, blood lipid, blood pressure and blood uric acid levels, and actively exercising to lose weight are of great significance for the occurrence and development of fatty liver.

Conflict of Interest

The author has read and approved the final version of the manuscript. The author has no conflicts of interest to declare.

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