Analysis of the Influence of Lifestyle on Liver Dysfunction Based on NAHANES Database

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Research Article

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Abstract

Objective

To find out the influence of various factors in life style on liver dysfunction, put forward reasonable suggestions on prevention of liver dysfunction.

Methods

Datasets from 2017 to March 2020 NHANES (National Health and Nutrition Examination Surveys) required for the analysis were downloaded from the NHANES web site and R 4.1.1. Software was used for data analysis. Survey Design Logisitic regression was used to analyze the influence of various factors on liver dysfunction and screen the risk factors.

Results

hypertension, depression, and sedentary activity are risk factors for liver dysfunction, while reducing salt in diet and vigorous recreational activities were protective factors for liver dysfunction. The inflection points of blood pressure, BMI and sedentary activity were 98.33mmHg, 30.6kg/m², 420min, respectively.

Conclusions

Blood pressure, BMI, mood and sedentary behavior are risk factors for liver dysfunction. We suggest that keeping MAP level at 70-98.33mmHg, controlling BMI < 30kg/m², maintaining a positive attitude, and sedentary time less than 420 min per day are more conducive to reducing the risk of liver dysfunction.

1. Introduction

Liver is the largest substantial and digestive organ of the human body, with a variety of functions such as secretion, synthesis, metabolism and excretion. Various factors such as virus, pathology and chemical substances can affect the normal structure of liver parenchyma cells and tissue, causing liver dysfunction(1). With the growth of age, the structure and function of liver will change, including Alanine aminotransferase (ALT)(2), Volume(3), etc.

Different lifestyles affect liver function through a variety of factors, such as alcohol, drugs, and gut flora. Changes in gut microbiota can have a big impact on the liver, as gut bacteria and their by-products can enter the liver through the portal vein(4). Alcohol is the most common cause of liver damage. Nearly all people who consume alcohol for a long time develop fatty liver, but only a small proportion develop cirrhosis(5, 6), which leads to liver dysfunction. But there are also some people in the occurrence of liver dysfunction before the discovery of liver diseases, many factors in life may be the cause of disease, but lack of relevant research. Intestinal microbiota changes occur in many liver diseases, such as nonalcoholic fatty liver disease, cirrhosis, alcoholic cirrhosis, and cirrhosis with encephalopathy(7). In addition, different lifestyles can also affect liver function to varying degrees, but there is still a lack of research on this aspect. Therefore, this study was conducted to study working time, activity, mood, blood pressure, sleep time, smoking and other lifestyle factors, in order to find the influence of different life factors on liver dysfunction and provide reference for the prevention of liver dysfunction.

2. Methods

2.1 Study Sample

Datasets from 2017 to March 2020 NHANES (National Health and Nutrition Examination Surveys) required for the analysis were downloaded from the NHANES web site and R 4.1.1. Software was used for data combined. The respondents included in this study were all over 20 years old, all accepted complete NHANES surveys, including Blood Pressure, Diabetes, Medical Conditions, Mental Health, Physical Activity, Use, Prescription, Medications, Sleep Disorders, Smoking, etc. After excluding respondents with incomplete survey data, a total of 11388 respondents were included in this study, including 5034 males and 6354 females. Characteristics of respondents are described in Table 1.

2.2 Classification of indicators

All indexes included in the study were converted into dichotomous variables. If the depression index occurred More than "More than half the days", the event was considered to have occurred. The time of sedentary activity is bounded by 8 hours. If the time exceeds 8 hours, the event is considered to occur. Mean arterial pressure (MAP) was used to reflect blood pressure to study the relationship between blood pressure and liver dysfunction. $MAP = \text{Diastolic blood pressure} + 1/3 * \text{Systolic blood pressure}$.

2.3 Diagnostic criteria for liver dysfunction

Biochemical indicators were used for diagnosis : (1) Alanine Aminotransferase (ALT) or Aspartate Aminotransferase (AST) > 1-3ULN; (2) Alkaline Phosphatase (ALP) > 1-2.5 ULN; (3) Bilirubin (BIL) > 1-1.5ULN. At least one criterion was met to consider the respondents to have liver dysfunction in this study (8, 9).

2.4 Statistical analysis

Analyses were conducted using R 4.1.1. Survey Design Logistic regression was used to analyze the influence of various factors on liver dysfunction and screen the risk factors. The risk factors of liver dysfunction were stratified by sex, age, race and education level. Then the trend P test was carried out for several important factors. Smooth curve fitting was made for mean arterial pressure, body mass index (BMI) and sedentary activity time to find the inflection point of the curve.

3. Results

3.1 Analysis of the influence of various factors on liver dysfunction

After analyzing lifestyle-related factors in the NHANES database, we found that we found that hypertension (OR=1.851, [1.001,3.4222], P=0.0493), depression (mainly manifested as negative emotions) (Feeling down/Depressed/Hopeless, OR=1.606, [1.015,2.541], P=0.042; Feeling bad about yourself, OR=1.95, [1.292,2.942], P=0.001), overweight (OR=2.079, [1.197,3.611], P=0.009), mental illness (OR=1.609, [1.016,2.549], P=0.043 and sedentary activity (OR=2.164, [1.144,4.095], P=0.018) are risk factors for liver dysfunction, while reducing salt in diet (OR=0.319, [0.203,0.503], P=0.001) and vigorous recreational activities (OR=0.241, [0.123,0.469], P=0.001) were protective factors for liver dysfunction. The other indicators were not statistically significant. The analysis of the influence of various factors on liver dysfunction is shown in Table 2 and Figure 1.

3.2 The relationship between blood pressure and liver dysfunction

We divided MAP into four groups and conducted trend P test. The results are shown in Table 3. The Model 1 has been non-adjusted. The Model 2 adjusted gender, race, education level, age, Marital status and Ratio of family income to poverty. The Model 3 adjusted for factors other than weight and liver dysfunction. Then smooth curve fitting was performed for MAP and liver dysfunction, stratified by gender, age, race and education level respectively, and the results were shown in Figure 2. We found that the risk of liver dysfunction in men increased first and then decreased with MAP,

with an inflection point of 134.33mmHg, while that in females showed an overall upward trend after a fluctuation of 98.33mmHg. The total inflection point was 98.33mmHg.

In age group, we found that the curve of 20-40 years old group did not change much, and began to rise after 111mmHg, and the risk of liver dysfunction increased with it. In the 40-60 years old group, the curve reached the first inflection point at 95mmHg. In the 60-80 years old group, the risk of liver insufficiency was higher when blood pressure was greater than 92mmHg. In the group older than 80 years, the overall trend was downward, and the risk changed little after 100.33mmHg. The total inflection point was 98.33mmHg.

In racial subgroups, we find that the curve of non-Hispanic White is stable and begins to rise after 142.67mmHg, and the curve of Mexican American and Other Race remains at a high level around 98mmHg. Mexican American declined after 140mm. Non-Hispanic Black fluctuated and began to decline after 154.67 mmHg. The total inflection point was 98.33mmHg.

In the education level group, we find that the curve of less high school graduate group remains at the high risk level after 108.33mmHg, and the curve of high school graduate/GED or Equivalent group begins to rise after 118mmHg. While College graduate or above group increased at 92.67 mmHg. The total inflection point was 109.67 mmHg.

3.3 The relationship between BMI and liver dysfunction

We divided BMI into four groups and conducted trend P test. The results are shown in Table 4. The Model 1 has been non-adjusted. The Model 2 adjusted gender, race, education level, age, Marital status and Ratio of family income to poverty. The Model 3 adjusted for factors other than weight and liver dysfunction. Then smooth curve fitting was performed for BMI and liver dysfunction, stratified by gender, age, race and education level respectively, and the results were shown in Figure 3.

In the gender group, with the change of BMI, the risk of liver dysfunction did not change significantly in women, but significantly in men. The risk decreased first and then increased significantly after 34.5kg/m². The total inflection point was 30.6 kg/m².

In age groups, 20-40 years old formed a steady upward trend, and the inflection points of 40-60 years old and 60-80 years old were 30.7 kg/m² and 25.8 kg/m², respectively. However, at the same BMI, the risk was lower than that of 20-40 years old, and the risk of > 80 years old decreased significantly after 22.9 kg/m². The total inflection point was 30.6 kg/m².

In race groups, the curve of non-Hispanic White years old group and over other Race group increased steadily, but the risk of liver dysfunction in non-Hispanic White years old group was much lower than that in over other Race group. The risk of liver dysfunction in Non-Hispanic Black group began to increase after 22.4 kg/m². The risk of liver dysfunction in Mexican American group increased significantly and reached the inflection point at 33.8 kg/m². Its risk of liver dysfunction was much higher than the other three groups. The total inflection point was 30.6 kg/m².

In the education level group, the less high school graduate group shows a downward trend as a whole, and the high school graduate/GED or Equivalent group drops after reaching the inflection point of 39.8 kg/m². College graduate or above group starts to rise at 29.9 kg/m². The total inflection point was 30.6 kg/m².

3.4 The relationship between sedentary activity time and liver dysfunction

We divided sedentary activity time into four groups and conducted trend P test. The results are shown in Table 5. The Model 1 has been non-adjusted. The Model 2 adjusted gender, race, education level, age, Marital status and Ratio of family income to poverty. The Model 3 adjusted for factors other than weight and liver dysfunction. Then smooth curve fitting was performed for sedentary activity time and liver dysfunction, stratified by gender, age, race and education level respectively, and the results were shown in Figure 4.

In the gender group, the curve of male fluctuated greatly and reached the lowest point at 600min, while the curve of female rose at 75min and was generally stable. The risk of liver dysfunction in female was lower than that in male. The total inflection point was 451min.

In age groups, the changes of 20-40 years old group and 40-60 years old group were not obvious and reached the inflection point at 660min. The curve of the group over 80 years old gradually decreased and leveled off after 150min. The risk of liver dysfunction in the 60-80 years old group was significantly higher than that in the other three groups, and reached the inflection point at 240min. The total inflection point was 420min.

In the race groups, the curves of non-Hispanic White group changed significantly and increased after 150min, non-Hispanic Black group increased steadily from 90min, and Mexican American group decreased after reaching the inflection point at 300min. The Other Race group gradually rises. The total inflection point was 420min.

In the educational level group, high school graduate/GED or equivalent group and college graduate or above group gradually increase, the less High school graduate group began to decline after reaching the inflection point in 420min. The total inflection point was 420min.

4. Discussion

Heart diseases such as chronic heart failure can cause abnormal liver function(10-12), which is closely related to changes in hemodynamics(13-15). Changes in hemodynamics will also be reflected in changes in blood pressure. In our study, the total inflection point of gender, age, and race was 98.33mmHg, and the total inflection point of education level was 109.67mmHg. Under the condition of ensuring the normal perfusion of body organs, blood pressure less than the inflection point may have a smaller occurrence The risk of liver dysfunction. Therefore, we consider that maintaining a MAP of 70-98.33mmHg in normal people is more conducive to reducing the risk of liver dysfunction.

Obesity is defined as $BMI > 30 \text{ kg/m}^2$, while morbid obesity is defined as $BMI > 40 \text{ kg/m}^2$ (16). BMI is an important indicator for evaluating human health, and it is also related to most diseases, including cardiovascular disease, reduced life expectancy, increased mortality, psychosocial problems, blood pressure, etc(17, 18). We found that BMI is related to the occurrence of liver dysfunction. Regardless of gender, age, race, and education level group, the total inflection point of BMI is 30.6 kg/m^2 . This is consistent with the diagnostic criteria for obesity with $BMI < 30 \text{ kg/m}^2$. Therefore, a lower BMI can reduce the risk of liver dysfunction.

Sedentary behavior is independently associated with adverse health outcomes(19-21), including obesity, metabolic syndrome (METs), non-alcoholic fatty liver disease (NAFLD), and type 2 diabetes(22-26). KELLY et al. also found that sitting was associated with fatty liver disease(27). However, these studies did not give the relationship between sedentary time and liver dysfunction, nor did they give a specific time. In the sedentary activity study, I found that the total inflection point in the gender group was 451 minutes, and the total inflection point in age, race, and education level group was 420 minutes. Therefore, we believe that a sedentary time of less than 420 minutes a day can reduce the risk of liver dysfunction (not including sleep time).

In our study, several evaluation indicators of depression are risk factors for liver insufficiency, which is consistent with the results of several previous studies. Studies have shown that about 20-30% of patients with liver disease suffer from depression(28-30). The specific cause is not clear, but this may be related to alcoholism and drug use(31, 32). Our research also found that seeing a psychiatrist in the past month is a risk factor for liver insufficiency, but taking prescription drugs is a protective factor. The prescription drugs here are not only antidepressants, probably because these drugs improve the patient's body condition.

In conclusion, blood pressure, BMI, mood and sedentary behavior are risk factors for liver dysfunction. We suggest that keeping MAP level at 70-98.33mmHg, controlling BMI < 30kg/m², maintaining a positive attitude, and sedentary time less than 420 min per day are more conducive to reducing the risk of liver dysfunction.

Declarations

Ethics declarations

Ethics approval and consent to participate

1.The data in this study comes from the NHANES database. After consulting the ethics committee of the PLA General Hospital, it is deemed that ethical procedures are not required □

2. Accordance statement

All authors of this article declare that all methods were carried out in accordance with relevant guidelines and regulations.

Consent for publication

Not applicable.

Availability of data and materials

The datasets generated during the current study are available in the NHANES (National Health and Nutrition Examination Surveys) repository.

[<https://www.cdc.gov/nchs/nhanes/index.htm>]

Competing interests

The authors declare that they have no competing interests.

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None.

Authors' contributions

Study concept and design: Yan XU, Rong LIU.

Data extraction: Yan XU;

Data analysis and interpretation: Yan XU.

Drafting of the manuscript: Yan XU;

critical revision of the manuscript for important intellectual content: Rong LIU.

Statistical analysis: Yan XU.

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Tables

Table 1 The characteristics of the population

liver dysfunction.	0	1	Standardize diff.	P value
Ratio of family income to poverty	3.04 ± 1.62	2.69 ± 1.64	0.213 (0.212, 0.214)	0.0091
Gender				<0.0001
Male	40.66	76.09	0.770 (0.769, 0.771)	
Female	59.34	23.91	0.770 (0.769, 0.771)	
Race				<0.0001
Non-Hispanic White	72.88	52.26	0.436 (0.435, 0.437)	
Non-Hispanic Black	9.01	5.37	0.141 (0.140, 0.142)	
Mexican American	4.99	27.86	0.649 (0.648, 0.650)	
Other Race	13.13	14.51	0.040 (0.039, 0.041)	
Education level				0.3723
less High school graduate	10.71	8.30	0.082 (0.081, 0.083)	
High school graduate/GED or equivalent	29.54	34.12	0.098 (0.097, 0.099)	
College graduate or above	59.75	57.58	0.044 (0.043, 0.045)	
marital status				0.0452
Married/Living with Partner	61.02	53.56	0.151 (0.150, 0.152)	
Widowed/Divorced/Separated	25.52	26.37	0.019 (0.018, 0.020)	
Never married	13.46	20.07	0.178 (0.177, 0.179)	
High blood pressure				0.5633
none	44.46	46.82	0.047 (0.046, 0.048)	
have	55.54	53.18	0.047 (0.046, 0.048)	
Diabetes				0.1251
none	74.28	79.78	0.131 (0.130, 0.132)	
have	25.72	20.22	0.131 (0.130, 0.132)	
Age				<0.0001
20-40	19.95	41.33	0.477 (0.476, 0.478)	
40-60	33.92	35.91	0.042 (0.041, 0.043)	
60-80	39.58	22.62	0.373 (0.372, 0.374)	
≥80	6.55	0.13	0.363 (0.362, 0.364)	

Table 2 Analysis of the influence of various factors on liver dysfunction

	Estimate	Std. Error	t value	exp(coef)	95%CI low	95%CI up	P value
(Intercept)	-3.55775	0.55656	-6.39236	0.02850	0.00957	0.08485	<0.000001
High blood pressure 1	0.61606	0.31338	1.96583	1.85161	1.00183	3.42221	0.049342
Diabetes 1	-0.40129	0.28450	-1.41049	0.66946	0.38331	1.16922	0.158421
Have little interest in doing things 1	-0.06890	0.23098	-0.29831	0.93342	0.59355	1.46788	0.765475
Feeling down/Depressed/Hopeless 1	0.47395	0.23397	2.02568	1.60633	1.01549	2.54093	0.042821
Troubles sleeping or sleeping too much 1	0.00842	0.24334	0.03460	1.00845	0.62593	1.62476	0.972401
Feeling bad about yourself 1	0.66784	0.20984	3.18263	1.95001	1.29247	2.94208	0.001463
Trouble concentrating on things 1	0.18523	0.26464	0.69994	1.20350	0.71644	2.02168	0.483980
Moving or speaking slowly or too fast 1	0.17970	0.24149	0.74413	1.19685	0.74556	1.92132	0.456816
Thoughts you would be better off dead 1	-0.06578	0.37443	-0.17567	0.93634	0.44948	1.95054	0.860554
Difficulty these problems have caused 1	0.29432	0.24237	1.21434	1.34221	0.83467	2.15837	0.224642
Overweight 1	0.73184	0.28169	2.59800	2.07891	1.19688	3.61093	0.009389
Controlling/losing weight 1	0.36391	0.29012	1.25433	1.43894	0.81487	2.54096	0.209748
Increasing exercise 1	0.03042	0.28371	0.10722	1.03089	0.59117	1.79767	0.914620
Reducing salt in diet 1	-1.14166	0.23138	-4.93415	0.31929	0.20288	0.50250	<0.000001
Reducing fat in diet 1	-0.44590	0.24053	-1.85379	0.64025	0.39958	1.02588	0.063795
Vigorous work activity 1	0.01203	0.30254	0.03976	1.01210	0.55936	1.83128	0.968283
Moderate work activity 1	-0.21537	0.19592	-1.09928	0.80624	0.54915	1.18369	0.271671
Walk or bicycle 1	-0.02088	0.24753	-0.08435	0.97934	0.60288	1.59085	0.932777
Vigorous recreational activities 1	-1.42441	0.34148	-4.17128	0.24065	0.12323	0.46996	0.000031
moderate recreational activities 1	0.58737	0.23972	2.45021	1.79926	1.12470	2.87839	0.014293
Products used in home to control insects 1	0.18224	0.40969	0.44481	1.19990	0.53754	2.67843	0.656462
Products used to kill weeds 1	-0.15248	0.44326	-0.34400	0.85857	0.36014	2.04687	0.730853
Taken prescription medicine past month 1	-1.40758	0.30153	-4.66815	0.24473	0.13553	0.44194	0.000003
Feel overly sleepy during day 1	-0.41541	0.21946	-1.89289	0.66007	0.42932	1.01484	0.058398
Smoked at least 100	-0.06138	0.22426	-0.27369	0.94047	0.60596	1.45962	0.784326

cigarettes in life 1							
Seen mental health professional past year 1	0.47564	0.23466	2.02694	1.60905	1.01583	2.54868	0.042692
Sedentary activity 1	0.77211	0.32535	2.37318	2.16432	1.14388	4.09508	0.017652
Sleep hours weekdays or workdays 1	-0.26880	0.40048	-0.67118	0.76430	0.34863	1.67556	0.502117
Sleep hours weekends 1	-0.61677	0.41868	-1.47314	0.53968	0.23755	1.22610	0.140742

Table 3 The association between mean arterial pressure and liver dysfunction

	model 1	model 2	model 3	P for trend
Gender				
male				
Q1	1	1	1	<0.001
Q2	1.6671 (0.3731, 7.4497) 0.503409	1.7595 (0.3589, 8.6252) 0.486025	1.6997 (0.3734, 7.7375) 0.492739	
Q3	1.9441 (0.5067, 7.4592) 0.332552	1.8483 (0.4225, 8.0850) 0.414607	1.5150 (0.4395, 5.2230) 0.510605	
Q4	1.7876 (0.4588, 6.9645) 0.402484	1.8066 (0.3997, 8.1657) 0.442194	1.2370 (0.2825, 5.4162) 0.777675	
female				
Q1	1	1	1	<0.001
Q2	0.4091 (0.0798, 2.0977) 0.283848	0.3531 (0.0702, 1.7747) 0.206341	0.6494 (0.2006, 2.1020) 0.471284	
Q3	0.2918 (0.0526, 1.6177) 0.158660	0.2633 (0.0395, 1.7530) 0.167691	0.4086 (0.0830, 2.0107) 0.270927	
Q4	0.6316 (0.1562, 2.5543) 0.519226	0.7127 (0.1570, 3.2358) 0.660816	0.9090 (0.3040, 2.7185) 0.864475	
total				
Q1	1	1	1	<0.001
Q2	0.9355 (0.3154, 2.7745) 0.904300	0.9236 (0.2979, 2.8632) 0.890491	0.9171 (0.3216, 2.6155) 0.871400	
Q3	1.0188 (0.3881, 2.6747) 0.969779	0.9971 (0.3498, 2.8418) 0.995644	0.9690 (0.3918, 2.3962) 0.945612	
Q4	1.1149 (0.4305, 2.8873) 0.822704	1.1637 (0.4065, 3.3316) 0.777495	1.0347 (0.3590, 2.9823) 0.949570	
Age				
20-40				
Q1	1	1	1	<0.001
Q2	0.4447 (0.1154, 1.7141) 0.239126	0.4257 (0.1111, 1.6308) 0.212651	0.5509 (0.1340, 2.2652) 0.408557	
Q3	3.0009 (1.0641, 8.4628) 0.037758	2.3531 (0.8375, 6.6113) 0.104477	2.4805 (0.8890, 6.9214) 0.082698	
Q4	2.7250 (1.0876, 6.8272) 0.032417	2.4313 (0.8908, 6.6361) 0.082883	6.6804 (1.8909, 23.6015) 0.003185	
40-60				
Q1	1	1	1	<0.001
Q2	0.3255 (0.0630, 1.6815) 0.180333	0.4128 (0.0832, 2.0473) 0.278837	0.3840 (0.1052, 1.4021) 0.147460	

Q3	0.2581 (0.0504, 1.3229) 0.104293	0.2391 (0.0452, 1.2641) 0.092154	0.3275 (0.0857, 1.2515) 0.102692	
Q4	0.6719 (0.1515, 2.9790) 0.600742	0.6945 (0.1559, 3.0938) 0.632427	0.7938 (0.3102, 2.0309) 0.629897	
60-80				
Q1	1	1	1	<0.001
Q2	5.6241 (0.5659, 55.8972) 0.140477	5.1427 (0.4443, 59.5310) 0.189976	inf. (inf., inf.) <0.000001	
Q3	2.7099 (0.2395, 30.6564) 0.420558	2.4651 (0.2093, 29.0326) 0.473341	inf. (inf., inf.) <0.000001	
Q4	1.5012 (0.1291, 17.4541) 0.745516	1.4586 (0.1031, 20.6268) 0.780022	0.0000 (0.0000, 0.0000) <0.000001	
80				
Q1	1	1	1	<0.001
Q2	0.0000 (0.0000, 0.0000) <0.000001	0.0000 (0.0000, 0.0000) <0.000001	0.0232 (0.0141, 0.0379) <0.000001	
Q3	0.0000 (0.0000, 0.0000) <0.000001	0.0000 (0.0000, 0.0000) <0.000001	0.0026 (0.0016, 0.0042) <0.000001	
Q4	0.0000 (0.0000, 0.0000) <0.000001	0.0000 (0.0000, 0.0000) <0.000001	0.0000 (0.0000, 0.0000) <0.000001	
total				
Q1	1	1	1	<0.001
Q2	0.9058 (0.2910, 2.8191) 0.864337	0.9236 (0.2980, 2.8624) 0.890463	0.9171 (0.3215, 2.6161) 0.871429	
Q3	1.0647 (0.3672, 3.0872) 0.908158	0.9971 (0.3510, 2.8323) 0.995630	0.9690 (0.3928, 2.3905) 0.945467	
Q4	1.2186 (0.4313, 3.4430) 0.709065	1.1637 (0.4078, 3.3207) 0.776820	1.0347 (0.3597, 2.9767) 0.949479	
Race				
Non-Hispanic White				
Q1	1	1	1	<0.001
Q2	0.6556 (0.0997, 4.3131) 0.660499	0.6253 (0.0942, 4.1519) 0.626894	0.6245 (0.1679, 2.3219) 0.482194	
Q3	0.6317 (0.1241, 3.2153) 0.580054	0.5938 (0.1151, 3.0650) 0.533700	0.6127 (0.1667, 2.2519) 0.460680	
Q4	0.7822 (0.1868, 3.2761) 0.736803	0.7890 (0.1543, 4.0337) 0.775922	1.4533 (0.3227, 6.5444) 0.626303	
Non-Hispanic Black				
Q1	1	1	1	<0.001
Q2	2.5723 (0.2292, 28.8700) 0.443782	3.0431 (0.2137, 43.3309) 0.411495	1.0009 (0.0060, 167.1816) 0.999715	

Q3	2.2886 (0.2042, 25.6490) 0.501900	1.7916 (0.2070, 15.5022) 0.596375	3.0432 (0.1190, 77.8171) 0.500989	
Q4	3.6081 (0.7188, 18.1116) 0.119027	3.6011 (0.7145, 18.1509) 0.120525	73.3031 (0.4763, 11281.1240) 0.094651	
Mexican American				
Q1	1	1	1	<0.001
Q2	2.3907 (0.2409, 23.7290) 0.456677	2.5392 (0.2472, 26.0807) 0.432993	0.4826 (0.0000, 3986866.4173) 0.928563	
Q3	8.4270 (1.8961, 37.4517) 0.005099	5.5422 (0.9782, 31.4023) 0.052984	140.6233 (0.0000, inf.) 0.522133	
Q4	3.5461 (0.4162, 30.2134) 0.246841	3.6287 (0.5277, 24.9535) 0.190133	0.0002 (0.0000, inf.) 0.593130	
Other Race				
Q1	1	1	1	<0.001
Q2	0.7806 (0.1466, 4.1560) 0.771611	0.7271 (0.1448, 3.6516) 0.698696	0.6648 (0.1862, 2.3741) 0.529576	
Q3	0.4646 (0.0717, 3.0093) 0.421292	0.4492 (0.0525, 3.8420) 0.464858	0.7300 (0.1477, 3.6078) 0.699436	
Q4	0.7896 (0.1359, 4.5891) 0.792482	0.6852 (0.1016, 4.6194) 0.697764	0.8276 (0.2266, 3.0217) 0.774535	
total				
Q1	1	1	1	<0.001
Q2	0.9377 (0.3140, 2.8004) 0.908299	0.9236 (0.2980, 2.8624) 0.890463	0.9171 (0.3215, 2.6161) 0.871429	
Q3	1.1389 (0.4238, 3.0608) 0.796463	0.9971 (0.3510, 2.8323) 0.995630	0.9690 (0.3928, 2.3905) 0.945467	
Q4	1.1932 (0.4655, 3.0586) 0.712976	1.1637 (0.4078, 3.3207) 0.776820	1.0347 (0.3597, 2.9767) 0.949479	
Educational level				
less High school graduate				<0.001
Q1	1	1	1	
Q2	0.7997 (0.1220, 5.2444) 0.815831	0.7225 (0.1364, 3.8276) 0.702403	0.0779 (0.0001, 49.9090) 0.438942	
Q3	0.2507 (0.0502, 1.2525) 0.091856	0.1257 (0.0201, 0.7855) 0.026539	0.1085 (0.0067, 1.7535) 0.117706	
Q4	0.0816 (0.0084, 0.7892) 0.030425	0.0489 (0.0045, 0.5293) 0.013015	0.0000 (0.0000, 1.2899) 0.054464	
High school graduate/GED or equivalent				
Q1	1	1	1	<0.001

Q2	1.9711 (0.3668, 10.5905) 0.428938	3.0368 (0.4645, 19.8547) 0.246230	5.6026 (0.7419, 42.3113) 0.094813	
Q3	5.8167 (1.4820, 22.8298) 0.011606	7.1592 (1.3856, 36.9907) 0.018813	11.1578 (1.5851, 78.5418) 0.015407	
Q4	3.2204 (0.9254, 11.2072) 0.066049	4.7116 (1.1260, 19.7140) 0.033790	24.3675 (2.3808, 249.3974) 0.007123	
College graduate or above				
Q1	1	1	1	<0.001
Q2	0.7829 (0.1638, 3.7428) 0.759172	0.7216 (0.1446, 3.6002) 0.690702	0.8143 (0.2744, 2.4161) 0.711222	
Q3	0.5882 (0.1658, 2.0874) 0.411559	0.5398 (0.1337, 2.1794) 0.386537	0.6041 (0.2328, 1.5673) 0.300089	
Q4	1.2589 (0.3390, 4.6750) 0.730906	1.3209 (0.3325, 5.2475) 0.692505	1.2754 (0.4516, 3.6015) 0.646061	
total				
Q1	1	1	1	<0.001
Q2	0.9553 (0.3253, 2.8054) 0.933620	0.9236 (0.2980, 2.8624) 0.890463	0.9171 (0.3215, 2.6161) 0.871429	
Q3	1.0908 (0.4180, 2.8462) 0.859080	0.9971 (0.3510, 2.8323) 0.995630	0.9690 (0.3928, 2.3905) 0.945467	
Q4	1.1420 (0.4412, 2.9558) 0.784374	1.1637 (0.4078, 3.3207) 0.776820	1.0347 (0.3597, 2.9767) 0.949479	

Table 4 The association between BMI and liver dysfunction

	model 1	model 2	model 3	P for trend
Gender				
male				
Q1	1	1	1	<0.001
Q2	2.6996 (1.0309, 7.0693) 0.043175	3.5250 (1.2656, 9.8180) 0.015921	3.2234 (1.0963, 9.4776) 0.033413	
Q3	1.8895 (0.6184, 5.7730) 0.264137	2.1458 (0.7077, 6.5058) 0.177298	1.6764 (0.4773, 5.8873) 0.420189	
Q4	3.4451 (1.2883, 9.2129) 0.013712	3.7417 (1.4663, 9.5483) 0.005767	3.0988 (0.6113, 15.7093) 0.172036	
female				
Q1	1	1	1	<0.001
Q2	0.6498 (0.1239, 3.4062) 0.609995	0.6318 (0.1056, 3.7791) 0.614892	0.9220 (0.2582, 3.2919) 0.900485	
Q3	0.3224 (0.0778, 1.3355) 0.118519	0.2944 (0.0638, 1.3592) 0.117181	0.7349 (0.1766, 3.0584) 0.672043	
Q4	0.6816 (0.1539, 3.0174) 0.613522	0.5613 (0.1206, 2.6134) 0.461811	1.5406 (0.3737, 6.3520) 0.549861	
total				
Q1	1	1	1	<0.001
Q2	1.4555 (0.5554, 3.8138) 0.445085	1.7350 (0.6251, 4.8158) 0.290099	1.6664 (0.6917, 4.0146) 0.254960	
Q3	0.9322 (0.3215, 2.7028) 0.897169	1.0173 (0.3411, 3.0342) 0.975463	1.2363 (0.4997, 3.0590) 0.646238	
Q4	1.6973 (0.6274, 4.5921) 0.297489	1.6982 (0.6033, 4.7800) 0.315863	2.2534 (0.6702, 7.5770) 0.189126	
Age				
20-40				
Q1	1	1	1	<0.001
Q2	3.3251 (0.7985, 13.8458) 0.098771	2.8470 (0.5726, 14.1542) 0.201015	2.3138 (0.5872, 9.1172) 0.230510	
Q3	1.6384 (0.5251, 5.1123) 0.395141	1.5979 (0.4957, 5.1509) 0.432594	2.1490 (0.4072, 11.3414) 0.367405	
Q4	4.7460 (1.6274, 13.8412) 0.004348	5.5588 (2.0494, 15.0778) 0.000753	8.0862 (1.9502, 33.5287) 0.003971	
40-60				
Q1	1	1	1	<0.001
Q2	1.4882 (0.2903, 7.6298) 0.633517	1.7046 (0.2995, 9.7019) 0.547781	1.7423 (0.5719, 5.3077) 0.328633	

Q3	1.0720 (0.1883, 6.1023) 0.937552	1.0447 (0.1812, 6.0232) 0.960989	1.6302 (0.3435, 7.7360) 0.538483	
Q4	0.5660 (0.0977, 3.2771) 0.525233	0.7068 (0.1075, 4.6488) 0.718024	0.5631 (0.0481, 6.5951) 0.647355	
60-80				
Q1	1	1	1	<0.001
Q2	1.2519 (0.2110, 7.4264) 0.804662	1.1327 (0.2196, 5.8413) 0.881675	0.0000 (0.0000, 0.0000) <0.000001	
Q3	0.5552 (0.0538, 5.7249) 0.621059	0.5971 (0.0473, 7.5328) 0.690128	0.0000 (0.0000, 0.0000) <0.000001	
Q4	1.4912 (0.2080, 10.6920) 0.690930	1.6204 (0.1734, 15.1408) 0.672035	inf. (inf., inf.) <0.000001	
80				
Q1	1	1	1	<0.001
Q2	0.0000 (0.0000, 0.0000) <0.000001	0.0000 (0.0000, 0.0000) <0.000001	0.6901 (0.4646, 1.0253) 0.066304	
Q3	0.0000 (0.0000, 0.0000) <0.000001	inf. (inf., inf.) <0.000001	20.5926 (11.8355, 35.8293) <0.000001	
Q4	0.0000 (0.0000, 0.0000) <0.000001	98061.3668 (34655.9689, 277471.1536) <0.000001	0.0047 (0.0020, 0.0110) <0.000001	
total				
Q1	1	1	1	<0.001
Q2	1.8037 (0.6540, 4.9743) 0.254428	1.7350 (0.6251, 4.8158) 0.290099	1.6664 (0.6917, 4.0146) 0.254960	
Q3	1.0508 (0.3554, 3.1074) 0.928590	1.0173 (0.3411, 3.0342) 0.975463	1.2363 (0.4997, 3.0590) 0.646238	
Q4	1.4871 (0.5423, 4.0778) 0.440660	1.6982 (0.6033, 4.7800) 0.315863	2.2534 (0.6702, 7.5770) 0.189126	
Race				
Non-Hispanic White				
Q1	1	1	1	<0.001
Q2	0.8494 (0.1875, 3.8470) 0.832230	0.9829 (0.1713, 5.6402) 0.984582	2.1093 (0.4417, 10.0733) 0.349466	
Q3	0.2062 (0.0473, 0.8986) 0.035530	0.2213 (0.0484, 1.0118) 0.051797	0.3577 (0.0544, 2.3540) 0.284888	
Q4	0.8927 (0.1750, 4.5545) 0.891380	0.8296 (0.1405, 4.8989) 0.836679	4.3909 (0.8510, 22.6564) 0.077190	
Non-Hispanic Black				
Q1	1	1	1	<0.001
Q2	7.5253 (0.7634, 74.1833) 0.083856	11.7526 (1.1804, 117.0177) 0.035605	7.5666 (0.1222, 468.4477) 0.336339	

Q3	7.7000 (0.7464, 79.4342) 0.086465	17.9587 (1.3132, 245.5863) 0.030449	5.0963 (0.4540, 57.2130) 0.186868	
Q4	4.2298 (0.3641, 49.1430) 0.249109	8.1162 (0.6781, 97.1386) 0.098269	0.3653 (0.0060, 22.2251) 0.630944	
Mexican American				
Q1	1	1	1	<0.001
Q2	5.3808 (0.4279, 67.6595) 0.192628	12.0973 (0.6320, 231.5734) 0.097869	51831.5354 (0.4081, inf.) 0.070217	
Q3	9.1636 (0.7517, 111.7067) 0.082509	14.1323 (0.8491, 235.2053) 0.064890	39171.5840 (0.7897, inf.) 0.055211	
Q4	11.2941 (1.2038, 105.9642) 0.033807	25.1096 (1.7421, 361.9171) 0.017896	57999.7217 (0.1947, inf.) 0.088085	
Other Race				
Q1	1	1	1	<0.001
Q2	2.0075 (0.4434, 9.0880) 0.365718	2.4778 (0.6207, 9.8905) 0.198858	2.4009 (0.5477, 10.5252) 0.245409	
Q3	0.5528 (0.1431, 2.1357) 0.389982	0.6193 (0.1434, 2.6741) 0.520829	0.9372 (0.0712, 12.3412) 0.960669	
Q4	1.9230 (0.5001, 7.3948) 0.341347	2.0313 (0.4611, 8.9478) 0.348889	6.8110 (0.9069, 51.1514) 0.062180	
total				
Q1	1	1	1	<0.001
Q2	1.4840 (0.5534, 3.9793) 0.432797	1.7350 (0.6251, 4.8158) 0.290099	1.6664 (0.6917, 4.0146) 0.254960	
Q3	0.9429 (0.3319, 2.6786) 0.912054	1.0173 (0.3411, 3.0342) 0.975463	1.2363 (0.4997, 3.0590) 0.646238	
Q4	1.5920 (0.6038, 4.1971) 0.347184	1.6982 (0.6033, 4.7800) 0.315863	2.2534 (0.6702, 7.5770) 0.189126	
Educational level				
less High school graduate				<0.001
Q1	1	1	1	
Q2	1.5505 (0.2159, 11.1337) 0.662789	1.4340 (0.1886, 10.9020) 0.727616	0.7594 (0.0837, 6.8877) 0.806763	
Q3	0.5445 (0.0885, 3.3515) 0.512084	0.3152 (0.0383, 2.5958) 0.283170	0.3333 (0.0239, 4.6456) 0.413683	
Q4	0.3087 (0.0424, 2.2457) 0.245687	0.2184 (0.0234, 2.0396) 0.181973	0.0864 (0.0013, 5.5709) 0.249353	
High school graduate/GED or equivalent				
Q1	1	1	1	<0.001

Q2	4.0334 (1.0215, 15.9257) 0.046551	6.0451 (1.2047, 30.3350) 0.028798	13.3565 (1.7562, 101.5786) 0.012277	
Q3	1.6134 (0.2541, 10.2444) 0.612023	2.3279 (0.2890, 18.7484) 0.427265	2.0670 (0.1206, 35.4314) 0.616492	
Q4	3.8008 (0.9241, 15.6329) 0.064233	6.2981 (1.3060, 30.3731) 0.021873	16.0986 (1.1359, 228.1657) 0.039959	
College graduate or above				
Q1	1	1	1	<0.001
Q2	0.9834 (0.2138, 4.5227) 0.982820	0.9982 (0.2187, 4.5560) 0.998165	1.1515 (0.3946, 3.3599) 0.796252	
Q3	0.9019 (0.2111, 3.8526) 0.889168	0.9868 (0.2318, 4.2005) 0.985678	1.3930 (0.4601, 4.2168) 0.557567	
Q4	1.4092 (0.3689, 5.3831) 0.615954	1.5191 (0.3420, 6.7474) 0.582602	1.9415 (0.4146, 9.0917) 0.399621	
total				
Q1	1	1	1	<0.001
Q2	1.5958 (0.5982, 4.2573) 0.350541	1.7350 (0.6251, 4.8158) 0.290099	1.6664 (0.6917, 4.0146) 0.254960	
Q3	0.9525 (0.3268, 2.7759) 0.928880	1.0173 (0.3411, 3.0342) 0.975463	1.2363 (0.4997, 3.0590) 0.646238	
Q4	1.5728 (0.6014, 4.1130) 0.355814	1.6982 (0.6033, 4.7800) 0.315863	2.2534 (0.6702, 7.5770) 0.189126	

Table 5 The association between Sedentary activity and liver dysfunction

	model 1	model 2	model 3	P for trend
Gender				
male				
Q1	1	1	1	<0.001
Q2	1.4427 (0.7146, 2.9125) 0.306505	1.7914 (0.8675, 3.6990) 0.115051	1.9454 (0.8525, 4.4395) 0.113889	
Q3	2.6882 (1.3181, 5.4822) 0.006534	3.2119 (1.5241, 6.7687) 0.002156	3.7611 (1.5796, 8.9552) 0.002764	
Q4	1.0737 (0.5203, 2.2157) 0.847432	1.4458 (0.6785, 3.0807) 0.339535	1.5477 (0.6501, 3.6847) 0.323718	
female				
Q1	1	1	1	<0.001
Q2	1.9259 (0.7902, 4.6942) 0.149335	1.7412 (0.7011, 4.3247) 0.232137	1.3549 (0.5168, 3.5522) 0.536817	
Q3	2.1130 (0.8167, 5.4671) 0.122949	1.9545 (0.7299, 5.2336) 0.182337	2.1853 (0.7652, 6.2404) 0.144230	
Q4	0.3420 (0.0963, 1.2143) 0.096971	0.2790 (0.0766, 1.0169) 0.053031	0.2121 (0.0539, 0.8343) 0.026461	
total				
Q1	1	1	1	<0.001
Q2	1.6016 (0.9224, 2.7810) 0.094320	1.9044 (1.0851, 3.3423) 0.024805	2.5296 (1.3838, 4.6243) 0.002567	
Q3	2.4745 (1.4005, 4.3720) 0.001809	2.7299 (1.5198, 4.9035) 0.000777	3.9461 (2.1025, 7.4063) 0.000019	
Q4	0.8438 (0.4626, 1.5394) 0.579858	0.9801 (0.5275, 1.8209) 0.949212	1.2835 (0.6614, 2.4908) 0.460614	
Age				
20-40				
Q1	1	1	1	<0.001
Q2	1.2486 (0.4749, 3.2829) 0.652528	1.3273 (0.4873, 3.6153) 0.579668	1.0123 (0.3289, 3.1153) 0.983047	
Q3	3.2118 (1.2479, 8.2666) 0.015558	2.9157 (1.0696, 7.9480) 0.036484	1.8898 (0.5762, 6.1978) 0.293587	
Q4	1.0797 (0.4063, 2.8689) 0.877774	1.4996 (0.5275, 4.2629) 0.447180	0.8189 (0.2423, 2.7678) 0.747761	
40-60				
Q1	1	1	1	<0.001
Q2	2.4082 (1.0563, 5.4904) 0.036588	2.3361 (1.0000, 5.4574) 0.050001	3.5866 (1.1524, 11.1626) 0.027463	

Q3	1.5659 (0.6028, 4.0682) 0.357199	1.4477 (0.5360, 3.9102) 0.465534	2.5685 (0.6924, 9.5283) 0.158438	
Q4	1.3251 (0.5571, 3.1517) 0.524265	1.2762 (0.5190, 3.1385) 0.595243	4.3943 (1.3249, 14.5740) 0.015521	
60-80				
Q1	1	1	1	<0.001
Q2	1.9811 (0.5787, 6.7816) 0.276199	2.1487 (0.6103, 7.5650) 0.233635	2.8051 (0.5421, 14.5155) 0.218744	
Q3	5.2559 (1.5612, 17.6946) 0.007379	5.9066 (1.6801, 20.7653) 0.005625	17.4979 (2.9034, 105.4558) 0.001790	
Q4	0.0000 (0.0000, Inf) 0.983547	0.0000 (0.0000, Inf) 0.982391	0.0000 (0.0000, Inf) 0.991156	
80				
Q1	1	1	1	<0.001
Q2	inf. (0.0000, Inf) 0.998972	5.8572 (0.0000, Inf) 0.999965	1462.5533 (0.0000, Inf) 0.999945	
Q3	1.0000 (0.0000, Inf) 1.000000	0.0000 (0.0000, Inf) 0.999659	36.1784 (0.0000, Inf) 0.999976	
Q4	1.0000 (0.0000, Inf) 1.000000	0.0000 (0.0000, Inf) 0.999648	43.6774 (0.0000, Inf) 0.999973	
total				
Q1	1	1	1	<0.001
Q2	1.9148 (1.1018, 3.3278) 0.021233	1.9044 (1.0851, 3.3423) 0.024805	2.5296 (1.3838, 4.6243) 0.002567	
Q3	2.9679 (1.6780, 5.2494) 0.000185	2.7299 (1.5198, 4.9035) 0.000777	3.9461 (2.1025, 7.4063) 0.000019	
Q4	0.9808 (0.5378, 1.7889) 0.949624	0.9801 (0.5275, 1.8209) 0.949212	1.2835 (0.6614, 2.4908) 0.460614	
Race				
Non-Hispanic White				
Q1	1	1	1	<0.001
Q2	3.1196 (0.7361, 13.2214) 0.122560	4.1884 (0.9566, 18.3392) 0.057293	6.6989 (1.2175, 36.8575) 0.028796	
Q3	4.9910 (1.1715, 21.2626) 0.029697	6.2213 (1.4235, 27.1895) 0.015128	13.2421 (2.4946, 70.2926) 0.002419	
Q4	0.8535 (0.1806, 4.0332) 0.841526	0.8475 (0.1759, 4.0823) 0.836555	2.2896 (0.3878, 13.5172) 0.360508	
Non-Hispanic Black				
Q1	1	1	1	<0.001
Q2	2.7347 (0.6094, 12.2710) 0.189037	3.5157 (0.7584, 16.2963) 0.108127	0.6827 (0.0703, 6.6259) 0.741983	

Q3	2.0240 (0.3908, 10.4832) 0.400758	3.6257 (0.6755, 19.4604) 0.132990	0.3959 (0.0160, 9.8122) 0.571562	
Q4	2.0065 (0.4150, 9.7016) 0.386399	2.9544 (0.5817, 15.0044) 0.191352	1.4651 (0.1304, 16.4607) 0.757004	
Mexican American				
Q1	1	1	1	<0.001
Q2	2.6261 (0.8764, 7.8691) 0.084646	3.8094 (1.0772, 13.4709) 0.037945	0.6379 (0.0784, 5.1880) 0.674201	
Q3	5.4871 (1.7827, 16.8898) 0.002999	4.8905 (1.3699, 17.4581) 0.014492	1.1202 (0.0934, 13.4295) 0.928652	
Q4	0.2538 (0.0282, 2.2884) 0.221666	0.2157 (0.0212, 2.1934) 0.194874	0.0096 (0.0000, 3.0870) 0.114793	
Other Race				
Q1	1	1	1	<0.001
Q2	0.7298 (0.2799, 1.9032) 0.519577	0.6844 (0.2565, 1.8266) 0.449002	0.8284 (0.2878, 2.3846) 0.727104	
Q3	1.4289 (0.4910, 4.1584) 0.512506	0.9343 (0.3034, 2.8765) 0.905672	1.0508 (0.3107, 3.5540) 0.936415	
Q4	1.8171 (0.7781, 4.2434) 0.167506	1.7612 (0.7144, 4.3418) 0.218931	1.1147 (0.3927, 3.1647) 0.838320	
total				
Q1	1	1	1	<0.001
Q2	1.8896 (1.0848, 3.2914) 0.024605	1.9044 (1.0851, 3.3423) 0.024805	2.5296 (1.3838, 4.6243) 0.002567	
Q3	3.0919 (1.7368, 5.5042) 0.000125	2.7299 (1.5198, 4.9035) 0.000777	3.9461 (2.1025, 7.4063) 0.000019	
Q4	1.1467 (0.6240, 2.1074) 0.659301	0.9801 (0.5275, 1.8209) 0.949212	1.2835 (0.6614, 2.4908) 0.460614	
Educational level				
less High school graduate				<0.001
Q1	1	1	1	
Q2	0.6379 (0.2223, 1.8308) 0.403289	0.7940 (0.2579, 2.4440) 0.687554	0.6169 (0.0831, 4.5817) 0.636836	
Q3	1.2849 (0.4465, 3.6973) 0.642019	1.7386 (0.5497, 5.4991) 0.346472	0.9822 (0.0935, 10.3160) 0.988049	
Q4	0.1451 (0.0178, 1.1837) 0.071464	0.1709 (0.0194, 1.5024) 0.111159	0.1299 (0.0040, 4.2130) 0.250226	
High school graduate/GED or equivalent				
Q1	1	1	1	<0.001

Q2	3.5732 (1.0647, 11.9916) 0.039253	4.4604 (1.2907, 15.4148) 0.018113	2.2732 (0.5321, 9.7103) 0.267661	
Q3	6.3206 (1.8592, 21.4883) 0.003144	11.1096 (3.0700, 40.2033) 0.000243	11.1489 (2.3240, 53.4846) 0.002578	
Q4	1.6604 (0.4476, 6.1595) 0.448419	2.5428 (0.6594, 9.8058) 0.175344	4.0530 (0.7731, 21.2493) 0.097819	
College graduate or above				
Q1	1	1	1	<0.001
Q2	1.8061 (0.7564, 4.3127) 0.183090	1.9885 (0.8233, 4.8029) 0.126558	2.5959 (1.0278, 6.5560) 0.043580	
Q3	2.2938 (0.9292, 5.6622) 0.071732	2.1180 (0.8453, 5.3071) 0.109303	2.6583 (0.9978, 7.0822) 0.050515	
Q4	1.1163 (0.4527, 2.7529) 0.811165	1.0974 (0.4386, 2.7461) 0.842546	1.1109 (0.4206, 2.9345) 0.831886	
total				
Q1	1	1	1	<0.001
Q2	1.6520 (0.9503, 2.8717) 0.075178	1.9044 (1.0851, 3.3423) 0.024805	2.5296 (1.3838, 4.6243) 0.002567	
Q3	2.5042 (1.4156, 4.4299) 0.001610	2.7299 (1.5198, 4.9035) 0.000777	3.9461 (2.1025, 7.4063) 0.000019	
Q4	0.9036 (0.4938, 1.6535) 0.742244	0.9801 (0.5275, 1.8209) 0.949212	1.2835 (0.6614, 2.4908) 0.460614	

Figures

Figure 1

The analysis of the influence of various factors on liver dysfunction.

a

b

c

d

Figure 2

Relationship between MAP and dysfunction, X38: liver insufficiency; X46: MAP; a: smooth curves of gender group, 1: male; 2: female; b: Smoothing curve for age group; 1: 20-40; 2: 40 - 60; 3: 60-80; 4: 80+; c: Smoothing curve of race group, 1: Non-Hispanic White; 2: Non-Hispanic Black; 3: Mexican American; 4: Other Race; d: Smoothing curve of education level; 1: Less High school graduate; 2: High school graduate/GED or equivalent; 3: College graduate or above.

Figure 3

Relationship between BMI and dysfunction, X38: liver insufficiency; X45: BMI; a: smooth curves of gender group, 1: male; 2: female; b: Smoothing curve for age group; 1: 20-40; 2: 40 - 60; 3: 60-80; 4: ≥80; c: Smoothing curve of race group, 1: Non-Hispanic White; 2: Non-Hispanic Black; 3: Mexican American; 4: Other Race; d: Smoothing curve of education level; 1: Less High school graduate; 2: High school graduate/GED or equivalent; 3: College graduate or above.

a

b

c

d

Figure 4

Relationship between sedentary activity time and dysfunction, X38: liver insufficiency; X46: sedentary activity time; a: smooth curves of gender group, 1: male; 2: female; b: Smoothing curve for age group; 1: 20-40; 2: 40 - 60; 3: 60-80; 4: ≥80; c: Smoothing curve of race group, 1: Non-Hispanic White; 2: Non-Hispanic Black; 3: Mexican American; 4: Other Race; d: Smoothing curve of education level; 1: Less High school graduate; 2: High school graduate/GED or equivalent; 3: College graduate or above.