

Supplementary Table 1 General characteristics of participants(n=4494) stratified by gender in the NHANES 2017-2018

Characters	Total (n=4494)	Male (n=2213)	Female (n=2281)	p- Value
Age (years)	47.13±17.49	46.24±17.39	47.99±17.53	0.001
18~39	38.37(36.27- 40.52)	40.26(37.12-43.49)	36.54(33.79- 39.39)	0.006
40~59	34.09(31.92- 36.34)	34.16(30.98-37.49)	34.03(31.09- 37.10)	
60~80	27.53(25.65-29.5)	25.57(22.99-28.33)	29.43(26.77- 32.24)	
Race/ethnicity				0.782
Hispanic	16.44(15.27- 17.68)	16.78(15.05-18.66)	16.11(14.56- 17.79)	
Non-Hispanic White	62.61(60.71- 64.47)	62.86(60.07-65.58)	62.37(59.77- 64.90)	
Non-Hispanic Black	10.54(9.75-11.39)	9.99(8.91-11.19)	11.07(9.96-12.29)	
Non-Hispanic Asian	5.67(5.18-6.21)	5.55(4.86-6.35)	5.79(5.11-6.55)	
Other races <sup>1</sup>	4.74(3.91-5.73)	4.81(3.64-6.34)	4.67(3.58-6.06)	
Education				0.010
More than high school	60.93(58.8-63.02)	58.47(55.29-61.58)	63.32(60.45- 66.09)	
High school or equivalent	27.61(25.66- 29.64)	29.1(26.23-32.16)	26.16(23.58- 28.91)	
Less than high school	11.39(10.4-12.46)	12.35(10.86-14.01)	10.46(9.2-11.88)	
Not recorded	0.07(0.03-0.16)	0.08(0.02-0.28)	0.06(0.02-0.17)	
Poverty-income ratio				0.076
<1.3	18.19(16.85- 19.61)	16.76(14.92-18.77)	19.57(17.67- 21.62)	
1.3-1.8	8.2(7.35-9.15)	8.14(6.93-9.54)	8.27(7.1-9.6)	
>1.8	63.57(61.6-65.51)	64.51(61.61-67.3)	62.67(59.95- 65.31)	
Not recorded	10.04(8.88-11.32)	10.6(8.86-12.63)	9.49(8.04-11.18)	
BMI group				<0.001
<25	27.6(25.63-29.65)	23.67(21.04-26.52)	31.39(28.57- 34.36)	
25~30	31.5(29.47-33.6)	34.77(31.71-37.96)	28.33(25.71- 31.11)	
≥30	40.4(38.24-42.6)	40.86(37.67-44.14)	39.95(37.06- 42.91)	
Not recorded	0.5(0.33-0.77)	0.69(0.4-1.21)	0.32(0.17-0.59)	
Physical activity level				<0.001
Inactive	50.77(48.54-53)	44.73(41.51-48.01)	56.6(53.57-59.58)	
Less active	7.43(6.31-8.73)	6.56(5.15-8.31)	8.28(6.64-10.29)	

Active			35.12(32.29-38.05)	
	41.8(39.61-44.02)	48.71(45.44-51.99)		
Daily alcohol drinking				<0.001
Non-drinkers	7.53(6.5-8.71)	5.73(4.42-7.41)	9.27(7.78-11.02)	
Moderate-drinkers	29.66(27.58-31.82)	32.04(28.98-35.27)	27.36(24.61-30.29)	
Heavy-drinkers	14.48(13-16.09)	7.4(5.93-9.21)	21.32(18.92-23.93)	
Binge-drinkers	32.79(30.72-34.94)	41.52(38.32-44.79)	24.36(21.83-27.07)	
Not recorded	15.54(14.15-17.03)	13.3(11.44-15.42)	17.7(15.73-19.86)	
History of diabetes				0.069
Yes	12.82(11.54-14.22)	13.67(11.77-15.8)	12(10.34-13.89)	
Having HBV infection				0.237
Yes	0.94(0.62-1.41)	1.12(0.61-2.04)	0.76(0.46-1.26)	
Having HCV infection				0.078
Yes	2.49(1.83-3.38)	2.95(1.94-4.47)	2.04(1.29-3.21)	
Dietary VC supplement				<0.001
Yes	38.03(35.85-40.27)	33.96(30.81-37.26)	41.97(38.98-45.01)	
Daily dose of supplement of VC, mg				<0.001
none	74.68(72.6-76.65)	79.22(76.32-81.86)	70.28(67.31-73.1)	
1-60	10.08(8.81-11.52)	8.08(6.46-10.06)	12.02(10.15-14.18)	
61-120	5.03(4.04-6.26)	4.47(3.11-6.39)	5.58(4.25-7.29)	
121-500	5.62(4.6-6.84)	4.36(3.26-5.82)	6.82(5.22-8.88)	
>500	4.59(3.7-5.68)	3.86(2.69-5.52)	5.29(4.06-6.87)	
Monthly dose of supplement of VC, mg				0.004
none	67.9(65.74-69.98)	69.59(66.37-72.63)	66.26(63.34-69.06)	
1-1800	15.28(13.75-16.94)	14.61(12.37-17.19)	15.92(13.93-18.14)	
1800-3600	5.79(4.75-7.06)	6.24(4.59-8.44)	5.36(4.19-6.83)	
>3600	11.03(9.66-12.57)	9.55(7.79-11.65)	12.46(10.46-14.78)	
Dietary VC intake by food, mg/d				<0.001
0-18.5	22.73(20.96-24.61)	22.44(19.92-25.19)	23.01(20.58-25.65)	
18.5-47.1	25.62(23.66-	26.20(23.31-29.31)	25.05(22.46-	

	27.68)		27.83)	
47.1-106.5	24.44(22.53-26.45)	22.23(19.55-25.16)	26.57(23.92-29.39)	
>106.5	21.68(19.94-23.52)	24.01(21.39-26.85)	19.42(17.21-21.85)	
Not recorded	5.53(4.72-6.47)	5.11(3.97-6.56)	5.94(4.85-7.25)	
Laboratory parameters				
Smoking(serum cotinine levels)				<0.001
<0.015	38.17(35.97-40.42)	33.27(30.14-36.57)	42.91(39.89-45.98)	
0.015-3	37.41(35.31-39.56)	37.11(34.02-40.31)	37.71(34.88-40.62)	
≥3	24.04(22.27-25.9)	29.4(26.62-32.33)	18.87(16.74-21.2)	
Not recorded	0.37(0.15-0.9)	0.22(0.09-0.53)	0.52(0.16-1.7)	
ALT(U/L)	47.13±17.49	46.24±17.39	47.99±17.53	0.001
ALB(g/L)	23.26±17.77	27.92±19.64	18.73±14.37	<0.001
ALP(U/L)	41.02±3.21	41.96±3.09	40.10±3.06	<0.001
AST(U/L)	76.34±25.33	76.54±25.67	76.15±25.00	0.601
GGT(U/L)	22.31±13.41	24.45±14.31	20.23±12.12	<0.001
TB(umol/L)	29.71±40.06	35.61±45.43	23.99±33.06	<0.001
Platelet(×10 <sup>9</sup> /L)	8.14±4.83	9.5±5.38	6.83±3.80	<0.001
CRP(mg/L)	244.79±61.42	229.79±54.99	259.30±63.78	<0.001
TC(mmol/L)	3.72±7.16	3.1±6.19	4.32±7.94	<0.001
Serum VC(umol/L)	51.29±29.39	46.16±24.9	56.25±32.40	<0.001
<30.9	25.39(23.51-27.38)	29.31(26.43-32.36)	21.61(19.23-24.19)	
30.9-50.5	23.01(21.24-24.87)	25.46(22.81-28.29)	20.64(18.35-23.14)	
50.5-67.0	24.94(23.01-26.96)	27.48(24.55-30.61)	22.48(20.05-25.11)	
≥67.0	26.67(24.74-28.69)	17.76(15.38-20.42)	35.27(32.41-38.24)	
Transient Elastography				
Median stiffness(kPa)	5.66±4.73	6.02±4.91	5.31±4.52	<0.001
Controlled attenuation parameter(dB/m)	262.47±62.7	272.47±63.2	252.80±60.65	<0.001
NAFLD				<0.001
Yes	37.23(35.13-39.39)	39.9(36.77-43.12)	34.65(31.86-37.55)	
MAFLD				<0.001
Yes	47.98(45.76-50.21)	53.56(50.26-56.82)	42.59(39.64-45.59)	
Liver fibrosis				<0.001

Yes	21.23(19.48-23.08)	24.65(22-27.52)	17.92(15.71-20.35)	
Liver cirrhosis				0.001
Yes	3.08(2.35-4.02)	3.92(2.75-5.55)	2.27(1.5-3.41)	

Note: Values are weighted mean±SD or weighted % (95% confidence interval). P values are weighted. <sup>1</sup>Other races include American Indian or Alaska Native, Native Hawaiian or other Pacific Islander, and multiracial persons.

Abbreviations: ALT, alanine aminotransferase; AST, aspartate aminotransferase; ALP, alkaline Phosphatase; ALB, albumin; BMI, body mass index; CRP, C reactive protein; GGT, gamma glutamyl transferase; HBV, hepatitis B virus; HCV, hepatitis C virus; MAFLD, metabolic dysfunction-associated fatty liver disease; NHANES, National Health and Nutrition Examination Survey; NAFLD, nonalcoholic fatty liver disease; TC, total cholesterol; TB, total bilirubin; VC, vitamin C.

Supplementary Table 2 Subgroup analysis of associations between serum vitamin C level and NAFLD(n=4494), NHANES 2017–2018.

<b>Full adjustment model OR (95%CI), P</b>				
<b>Quartiles of vitamin C , umol/L</b>	<b>Q1(&lt;30.9)</b>	<b>Q2(30.9-50.5)</b>	<b>Q3(50.5-67.0)</b>	<b>Q4(≥67.0)</b>
<b>Stratified by age group(years)</b>				
18-39	Reference	0.769(0.477,1.240) 0.281	0.541(0.330,0.888) 0.015	0.529(0.302,0.927) 0.026
40-59	Reference	0.678(0.407,1.131) 0.137	0.639(0.367,1.112) 0.113	0.808(0.451,1.447) 0.473
60-80	Reference	0.838(0.475,1.479) 0.542	1.085(0.631,1.865) 0.769	1.051(0.599,1.846) 0.861
<b>Stratified by gender</b>				
Male	Reference	0.744(0.492,1.125) 0.161	0.761(0.495,1.168) 0.212	0.960(0.596,1.548) 0.869
Female	Reference	0.776(0.502,1.200) 0.255	0.595(0.388,0.912) 0.017	0.657(0.423,1.021) 0.062
<b>Stratified by race</b>				
Hispanic	Reference	0.699(0.436,1.121) 0.137	0.671(0.402,1.118) 0.126	0.540(0.311,0.938) 0.029
Non-Hispanic White	Reference	0.691(0.423,1.128) 0.139	0.595(0.372,0.952) 0.031	0.837(0.513,1.366) 0.477
Non-	Reference	1.088(0.665,1.77)	1.426(0.849,2.39)	0.640(0.349,1.17)

Hispanic	e	9)0.737	5)0.179	3)0.149
Black				
Non-Hispanic	Referenc	0.572(0.301,1.08	0.296(0.149,0.58	0.197(0.092,0.42
Asian	e	5)0.087	6) <0.001	2) <0.001
Other	Referenc	0.986(0.328,2.95	0.481(0.163,1.41	1.510(0.427,5.34
racess <sup>1</sup>	e	8)0.979	9)0.185	6)0.523
<b>Stratified by BMI</b>				
<25kg/m <sup>2</sup>	Referenc	0.782(0.354,1.72	0.779(0.353,1.71	0.833(0.357,1.94
	e	4)0.542	7)0.536	4)0.673
25-30kg/m <sup>2</sup>	Referenc	0.849(0.509,1.41	0.799(0.484,1.31	0.712(0.412,1.23
	e	7)0.532	9)0.380	2)0.225
≥30kg/m <sup>2</sup>	Referenc	0.718(0.477,1.08	0.613(0.399,0.94	0.892(0.549,1.45
	e	0)0.112	1)0.025	0)0.645

Note: Full adjustment model adjusted for: gender; age; race; education; BMI; diabetes; physical activity status; serum cotinine levels; dietary vitamin C supplement, dietary vitamin C intake by food, and poverty income ratio. <sup>1</sup>Other races include American Indian or Alaska Native, Native Hawaiian, or other Pacific Islander, and multiracial persons.

Abbreviations: NHANES, National Health and Nutrition Examination Survey; BMI, body mass index; NAFLD, nonalcoholic fatty liver disease; OR, odds ratio; 95%CI, 95% confidence interval.

Supplementary Table 3 Subgroup analysis of associations between serum vitamin C level and MAFLD(n=4494), NHANES 2017–2018.

<b>Full adjustment model OR (95%CI), P</b>					
<b>Quartiles of vitamin C , umol/L</b>		<b>Q1(&lt;30.9)</b>	<b>Q2(30.9-50.5)</b>	<b>Q3(50.5-67.0)</b>	<b>Q4(≥67.0)</b>
<b>Stratified by age group(years)</b>					
18-39	Referenc	0.956(0.641,1.42	0.535(0.352,0.81	0.342(0.211,0.55	
	e	6)0.826	4)0.003	4) <0.001	
40-59	Referenc	0.460(0.274,0.77			
	e	4)0.003	0.464(0.265,0.81	0.516(0.291,0.91	
			4)0.007	5)0.024	
60-80	Referenc	1.304(0.761,2.23	0.923(0.544,1.56		0.648(0.370,1.13
	e	3)0.334	6)0.766	3)	0.128
<b>Stratified by gender</b>					
Male	Referenc	0.867(0.590,1.27	0.661(0.439,0.99	0.619(0.392,0.97	
	e	4)0.467	4)0.047	8)0.040	
Female	Referenc	0.755(0.505,1.13	0.496(0.334,0.73	0.411(0.275,0.61	

	e	1)0.173	8)0.001	6) <0.001
<b>Stratified by race</b>				
Hispanic	Referenc	0.813(0.508,1.30	0.664(0.400,1.10	0.389(0.231,0.65
	e	1)0.388	2)0.113	3)<0.001
Non-Hispanic	Referenc	0.766(0.499,1.17	0.492(0.325,0.74	0.495(0.324,0.75
White	e	5)0.222	5)0.001	6)0.001
Non-Hispanic	Referenc	0.761(0.499,1.16	0.928(0.581,1.48	0.450(0.265,0.76
Black	e	0)0.204	2)0.754	3)0.003
Non-Hispanic	Referenc	0.674(0.359,1.26	0.305(0.157,0.59	0.194(0.095,0.39
Asian	e	7)0.220	0) <0.001	7) <0.001
Other races <sup>1</sup>	Referenc	1.608(0.577,4.47	1.104(0.381,3.19	1.800(0.559,5.80
	e	6)0.364	9)0.856	1)0.325
<b>Stratified by BMI</b>				
<25kg/m <sup>2</sup>	Referenc	0.685(0.329,1.42	1.231(0.486,3.12	0.979(0.438,2.18
	e	7)0.312	1)0.661	7)0.959
25-30kg/m <sup>2</sup>	Referenc	1.001(0.606,1.65	0.644(0.393,1.05	0.729(0.432,1.23
	e	5)0.996	5)0.080	1)0.237
≥30kg/m <sup>2</sup>	Referenc	0.767(0.473,1.24	0.610(0.376,0.98	0.651(0.380,1.11
	e	3)0.281	9)0.045	2)0.116

Note: Full adjustment model adjusted for: gender; age; race; education; alcohol; HBV infection; HCV infection; physical activity status; serum cotinine levels; dietary vitamin C supplement, dietary vitamin C intake by food, and poverty income ratio. <sup>1</sup>Other races include American Indian or Alaska Native, Native Hawaiian or other Pacific Islander, and multiracial persons.

Abbreviations: NHANES, National Health and Nutrition Examination Survey; MAFLD, metabolic dysfunction-associated fatty liver disease; OR, odds ratio; 95%CI, 95% confidence interval.

Supplementary Table 4 Subgroup analysis of associations between serum vitamin C level and significant liver fibrosis(n=4494), NHANES 2017–2018.

<b>Full adjustment model OR (95%CI), P</b>				
<b>Quartiles of vitamin C, umol/L</b>	Q1(<30.9)	Q2(30.9-50.5)	Q3(50.5-67.0)	Q4(≥67.0)
<b>Stratified by age group(years)</b>				
18-39	Referenc	0.458(0.286,0.73	0.338(0.192,0.59	0.511(0.243,1.07
	e	2)0.001	4) <0.001	5)0.077
40-59	Referenc	0.697(0.420,1.15	0.516(0.289,0.92	0.962(0.509,1.81
	e	5)0.161	1)0.025	8)0.904
60-80	Referenc	0.672(0.394,1.14	0.804(0.469,1.37	0.396(0.212,0.74
	e	7)0.145	7)0.427	0)0.004
<b>Stratified by gender</b>				
Male	Referenc	0.561(0.381,0.82	0.452(0.291,0.70	0.722(0.408,1.27

	e	6)0.003	3) <0.001	9)0.265
Female	Referenc	0.701(0.452,1.08	0.716(0.439,1.16	0.515(0.295,0.90
	e	7)0.112	7)0.180	2)0.020
<b>Stratified by race</b>				
Hispanic	Referenc	0.733(0.430,1.24	0.506(0.280,0.91	0.509(0.253,1.02
	e	8)0.252	6)0.024	5)0.059
Non-Hispanic White	Referenc	0.449(0.276,0.73	0.502(0.304,0.82	0.590(0.329,1.05
	e	2)0.001	7)0.007	9)0.077
Non-Hispanic Black	Referenc	1.440(0.905,2.29	1.264(0.757,2.11	0.992(0.546,1.80
	e	2)0.124	2)0.370	5)0.980
Non-Hispanic Asian	Referenc	0.499(0.236,1.05	0.342(0.153,0.76	0.435(0.196,0.96
	e	5)0.069	6)0.009	4)0.040
Other races <sup>1</sup>	Referenc	0.515(0.148,1.78	0.396(0.114,1.38	0.190(0.040,0.90
	e	9)0.296	4)0.147	0)0.036
<b>Stratified by BMI</b>				
<25kg/m <sup>2</sup>	Referenc	0.677(0.361,1.27	0.378(0.156,0.91	0.603(0.185,1.97
	e	0)0.225	9)0.032	1)0.403
25-30kg/m <sup>2</sup>	Referenc	0.715(0.393,1.30	0.386(0.195,0.76	0.604(0.313,1.16
	e	2)0.273	6)0.006	6)0.133
≥30kg/m <sup>2</sup>	Referenc	0.567(0.386,0.83	0.748(0.484,1.15	0.536(0.323,0.88
	e	3)0.004	8)0.193	7)0.015

Note: Full adjustment model adjusted for: gender; age; race; education; alcohol; diabetes; HBV infection; HCV infection; physical activity status; serum cotinine levels; dietary vitamin C supplement; dietary vitamin C intake by food; BMI, and poverty income ratio. <sup>1</sup>Other races include American Indian or Alaska Native, Native Hawaiian or other Pacific Islander, and multiracial persons.

Abbreviations: NHANES, National Health and Nutrition Examination Survey; BMI, body mass index; OR, odds ratio; 95%CI, 95% confidence interval.