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Evaluation nutritional status and anthropometric parameters in patients with chronic hepatitis B

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ABSTRACT

Introduction: Hepatitis B continues to be a major health problem around the world. 257 million people are estimated to be chronically infected with hepatitis B worldwide. Chronic hepatitis B (CHB) patients are likely to develop various comorbidities, including diabetes, insulin resistance, hyperlipidemia, nonalcoholic fatty liver disease, and obesity. Proper nutrition is essential for the management of both hepatitis B and its associated comorbidities.

Material and Method: The study was completed a total of 105 patients. The universe of the study comprised of CHB patients who were admitted to the nutrition and dietetics outpatient clinic of a public hospital in Turkey between 1 October 2019 and 31 December 2019. Biochemical and ultrasound results, anthropometric measures, demographic characteristics, dietary habits, and 1-day food records were retrospectively recorded from patient files.

Results: Female patients were more likely to consume 2 main meals per day (57.8%) whereas most male subjects (75.6%) consumed 3 meals. Both female and male patients had above-normal Body Mass Index (BMI) (31.2 kg/m² and 29.2 kg/m², respectively), and they also had high dietary fat (%) and cholesterol consumption than recommendation. In addition, males had borderline The fasting blood glucose (FBG), total cholesterol, and triglyceride levels, and both sexes were at risk for abdominal obesity. Dietary carbohydrate, fiber, B1, B6, calcium, magnesium, and phosphorus intake were higher in males than in females.

Conclusion: This study was found on above-normal BMI values, and high dietary fat (%), and cholesterol consumption in both males and females. Moreover, males had borderline FBG, total cholesterol, and triglyceride levels, and both sexes were at risk for abdominal obesity. In the setting of CHB, it is crucial to maintain an adequate and balanced diet to control body weight, prevent nutritional disorders, protect the liver, and improve overall well-being. More comprehensive studies are needed to better understand the link between nutrition and hepatitis B.

Keywords: Chronic hepatitis B virus infection, nutritional status, body composition, body weights and measures

INTRODUCTION

Hepatitis B virus (HBV), a major infectious disease, continues to be a leading global public health concern. Despite vaccination efforts, millions of people become infected with the HBV every year (1). According to the World Health Organization (WHO), 257 million people are chronically infected with HBV worldwide as of 2015. As of 2016, 27 million people – only 10.5% of all people estimated to be chronically infected with hepatitis B (HB) – are aware of their infection, while only 4.5 million (16.7%) of the diagnosed individuals are receiving treatment (2). The prevalence of CHB varies among geographical regions. The prevalence of CHB is <2% in Northern America and Western Europe, 2-7% in Mediterranean countries, the Middle East, Japan, Central Asia, and parts of South America, and is up to ≥8% in South Sudan and West Africa (3). In Turkey, 3.3 million individuals (4.57% of the general population) are estimated to be chronically infected with HB (4).

Hepatitis B infection is often divided into three types: acute, chronic, and occult. The most important indicator for the definitive diagnosis of chronic HBV infection is the presence of HBsAg in the blood for longer than six months (5). All patients with chronic HBV infection are at risk of developing hepatocellular carcinoma (HCC) and cirrhosis depending on host and viral factors (1). Obesity is known to be associated with HCC and also contributes to the development of , non-alcoholic fatty liver disease (NAFLD), hepatic steatosis, and non-

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alcoholic steatohepatitis due to its negative effects on the liver (6). The main purpose of HBV treatment is to improve survival and quality of life by preventing the progression of the disease, and therefore the development of HCC (1). CHB infection can be treated with medications, which can slow the progression of cirrhosis, reduce the risk of developing HCC, and improve long-term survival. WHO recommends oral tenofovir or entecavir treatment as the most potent approach to suppress HBV (2).

Patients with CHB may or may not require medication, but adequate and balanced nutrition is essential for liver health and overall well-being. The diet should be rich in protein, energy, and vitamins, and also include fresh fruits, whole grains, fish, lean protein, and plenty of vegetables (7).

In the setting of acute or chronic liver diseases, the risk of developing eating and malabsorption disorders, nausea, anorexia, and malnutrition are increased. Moreover, CHB patients are likely to develop various comorbidities, including diabetes, insulin resistance, hyperlipidemia, nonalcoholic fatty liver disease, and obesity. Proper nutrition is prominent in the management of both HB and the associated comorbidities. There are very few studies on the nutritional status of patients with hepatitis B both in Turkey and worldwide. In this study, we aimed to investigate the general eating habits, nutritional status, and anthropometric parameters of patients with CHB, and to compare the sexes.

MATERIAL AND METHOD

This study is a retrospective descriptive cross-sectional study. The universe of the study comprised of CHB patients who were admitted to the nutrition and dietetics outpatient clinic of a public hospital in Turkey between 1 October 2019 and 31 December 2019. Patient files were retrospectively reviewed and biochemical test results, anthropometric measures (body analysis results, height, hip and waist circumference), dietary habits, and food consumption records were retrospectively recorded from patient files. Because the study was designed retrospectively, no written informed consent form was obtained from patients.

This study was granted ethical approval by the İstanbul Okan University Non-Interventional Research Ethics Committee (Date 29.04.2020, Decision No: 56665618-204.01.07). All procedures were carried out in accordance with the ethical rules and the principles of the Declaration of Helsinki.

For every patient that presents to the dietetics outpatient clinic, demographic characteristics, overall nutritional habits, and physical activity, sleep duration, drug use, and a 1-day food record are electronically recorded prior to the prescription of a diet. Moreover, height and waist and hip circumference and body composition are measured. The BMI was computed by dividing body weight (kg) by height (m^2). According to the WHO, the BMI classification was used. The BMI was defined as underweight if it was less than 18.5 kg/m^2, normal if it was between 18.5-24.9 kg/m^2, overweight if it was between 25.0-29.9 kg/m^2, and obese if it was more than 30.0 kg/m^2 (8). The midpoint between the lower border of the last palpable rib and the top of the iliac crest was used to calculate waist circumference. Hip circumference was measured the circumference going through the highest point on the hip from the right side of the patients. The waist/hip ratio was determined by dividing the waist circumference (cm) by the hip circumference (cm). The waist/height ratio was assessed according to the classification according to WHO recommendations. Waist circumference measurements were classified as ≥94 cm risky in men, ≥102 cm high risk, ≥80 cm risky in women, and ≥88 cm high risk. A waist/hip ratio >1.0 in men and >0.8 in women was considered android obesity (9).

Body composition parameters were assessed using Tanita BF-350 Total Body Composition Analyzer, and heights were measured with a Seca stadiometer. An inflexible measuring tape was used for waist and hip measurements.

The International Physical Activity Questionnaire (IPAQ-Short Form) was used to determine the patients' physical activity status. The IPAQ technique was used to score physical activity. Patients with a total score of 600 Metabolic Equivalent Minutes (MET) on the physical activity scale were classified sedantary, patients with 600-3000 MET were classified moderate active, and patients with >3000 MET were classified very active (10).

Daily energy and nutrient intake were analyzed using "Computer Assisted Nutrition Program, Nutritional Information Systems Package Program (BEBIS)" developed for the Turkish population. TUBER was used to evaluate the data collected.

The ultrasonography findings of the patients were used to make the diagnosis of steatosis. The classification was based on ultrasonography data.

The data was analyzed using the Statistical Package for the Social Sciences (SPSS) version 22.0. All statistical analyses were performed with parametric tests. In addition to descriptive statistical methods (mean, standard deviation), the t test was used to determine the difference between two means, and the chi-square test and Pearson's correlation analysis were used to investigate correlations. $p<0.05$ was accepted as statistically significant.

RESULTS

The study included a total of 105 patients (64 females [61%] and 41 males [39%]). 78.1% of female participants and none of male patients were unemployed. Most female (54.7%) and male (58.5%) patients had completed only primary education. 28.1% of females and 36.6% of males were on medication for hepatitis B. Female patients were more likely to consume 2 main meals per day (57.8%) whereas most male subjects (75.6%) consumed 3 meals (**Table 1**). Grade 1 and 2 steatoses were more common among females. About half (48.6%) of all patients had a chronic disease other than hepatitis. 23% of the patients had been diagnosed with diabetes, the majority of which (74.4%) were female. 15.7% of the patients had concomitant heart disease, which was more common in women (62.5%) than in men.

The anthropometric measurement and body analysis results were evaluated. For females, the mean height was 157.2 cm, mean body weight was 77.0 kg, mean BMI was 31.2 kg/m², mean lean mass was 46.9 kg, and mean fat mass was 30 kg. For males, the mean height was 171.5 cm, mean body weight was 85.9 kg, mean BMI was 29.2 kg/m², mean lean mass was 63.4 kg, and mean fat mass was 22.4 kg. Females had significantly higher BMI, hip circumference, and fat mass and percentage whereas males had significantly higher lean body mass and percentage ($p<0.05$) (**Table 2**).

More than half of females and 41.5% of males were obese. When the waist-to-hip ratio was evaluated, 70.3% of female patients were evaluated to be at risk, and 73.2% of male patients were not at risk. Patients of both sexes most commonly reported moderate physical activity. Sex was significantly associated with BMI, waist-to-hip ratio, and MET levels ($p<0.05$) (**Table 3**).

Table 1. Distribution of some characteristics of the patients according to the gender

Characteristic	Women (n=64)		Men (n=41)	
	n	%	n	%
Job				
Unemployed	50	78.1	-	-
Employed	14	21.9	41	100.0
Education				
Literate	11	17.2	1	2.4
Primary school	35	54.7	24	58.5
Secondary school	6	9.4	4	9.8
High school	6	9.4	10	24.4
Associate degree	2	3.1	0	0.0
University	4	6.3	2	4.9
Marital status				
Married	49	76.6	41	100.0
Single	6	9.4	0	0.0
Widowed/divorced	9	14.1	0	0.0
Hepatitis medication use				
Yes	18	28.1	15	36.6
No	46	71.9	26	63.4
Number of main meals				
2	37	57.8	10	24.4
3	27	42.2	31	75.6
Number of snacks				
None	1	1.6	8	19.5
1	24	37.5	15	36.6
2	33	51.6	13	31.7
3	6	9.4	5	12.2
Meal skipping				
Yes	53	82.8	36	87.8
No	5	7.8	4	9.8
Sometimes	6	9.4	1	2.4
Liver fatty degree (n=63)				
Normal	15	37.5	5	21.7
Grade 1	15	37.5	13	56.5
Grade 2	7	17.5	3	13.0
Grade 3	3	7.5	2	8.7
Sleep duration				
Short sleep (<7 hour)	27	42.2	22	53.7
Moderate sleep (7-8 hour)	24	37.5	16	39.0
Long sleep (>8 hour)	13	20.3	3	7.3

Table 2. Comparison of anthropometric measurement and body analysis values of the patients according to the gender

	Women (n=64)	Men (n=41)	t	p
Body weight (kg)	77.05±14.22	85.9±10.93	-3.599	0.001*
Height (cm)	157.25±6.53	171.51±6.96	-10.645	<0.001*
BMI (kg/m²)	31.26±5.89	29.24±3.58	2.173	0.032*
Waist circumference (cm)	97.46±14.09	100.2±8.15	-1.269	0.207
Hip circumference (cm)	108.56±11.25	104.34±6.09	2.487	0.015*
Waist-hip ratio	0.89±0.09	0.96±0.044	-4.729	<0.001*
Lean mass (kg)	46.99±5.19	63.43±6.42	-14.419	<0.001*
Lean mass (%)	61.99±7.08	74.27±5.56	-9.397	<0.001*
Fat mass (kg)	30.07±10.40	22.49±6.97	4.108	<0.001*
Fat mass (%)	37.97±7.13	25.73±5.60	9.306	<0.001*
Water ratio (%)	45.25±5.01	54.61±4.42	-9.772	<0.001*

Independent Sample T Test, *p<0,05

Table 3. Comparison of BMI, waist/hip risk, MET level classifications of the patients according to gender

	Women		Men		X2	p *
	n	%	n	%		
BMI					6.092	0.048*
Normal	13	20,3	5	12,2		
Overweight	15	23,4	19	46,3		
Obese	36	56,3	17	41,5		
Total	64	100,0	41	100,0		
Waist-hip ratio risk					18.985	<0.001*
Yes	45	70,3	11	26,8		
No	19	29,7	30	73,2		
Total	64	100,0	41	100,0		
MET level					13.520	0.001*
Sedantary	6	9,4	3	7,3		
Moderate	58	90,6	30	73,2		
Vigorous	0	0,0	8	19,5		
Total	64	100,0	41	100,0		

Chi Square test, *p<0,05

Dietary carbohydrate, fiber, B1, B6, magnesium, and phosphorus intake, and glycemic index were higher in males than in females (p<0.05). Women consumed significantly less calcium than males (648.47±291.39 mg vs. 860.93±423.33 mg). Vitamin D intake was higher in males, but this finding was not statistically significant (p>0.05) (**Table 4**).

The blood biochemistry results of the patients were analyzed, and it was observed that male patients had elevated FBG levels (106.61±50.33 mg/dL), but the FBG results of two sexes were not significantly different. Males had significantly higher ALT levels, and females had significantly higher HDL levels compared to males (54.16 mg/dL vs. 44.46 mg/dL, p<0.05) (**Table 5**).

The correlation between steatosis and BMI classes and waist-to-hip ratio was not significantly different for the two sexes (p>0.05). There was a significant positive correlation between BMI and serum cholesterol (r=0.253, p=0.44), LDL cholesterol (0.286, p=0.22), and triglyceride (r=0.341, p=0.006) levels in female patients. BMI was not significantly associated with biochemistry parameters in males.

Table 4. Comparison of the mean intakes of energy, macro and micronutrients of the patients according to the gender

Nutrients	Women (n=64)	Men (n=41)	t	p*
	Mean±SD	Mean±SD		
Energy (kcal)	1876.50±1735.46	2387.46±1016.56	-1.705	0.091
Protein (g)	70.46±85.15	89.48±43.05	-1.324	0.188
Protein (%)	14.98±3.99	15.34±4.42	-0.428	0.669
Fat (g)	85.88±136.76	87.30±36.71	-0.065	0.949
Fat (%)	38.54±12.96	34.22±10.82	1.776	0.079
Carbohydrate (g)	201.49±116.29	304.74±166.89	-3.460	0.001*
Carbohydrate (%)	46.54±13.52	50.39±11.43	-1.507	0.135
Glycemic Index	194.93±158.60	304.55±239.82	-2.587	0.012*
Fiber (g)	20.69±12.42	28.08±16.64	-2.600	0.011*
Alcohol	0.01±0.04	0.01±0.08	-0.425	0.672
Vitamin E (mg)	12.26±9.61	12.76±9.57	-0.261	0.795
Vitamin D (µg)	1.93±2.96	3.16±7.79	-1.140	0.257
Vitamin K (mg)	95.05±110.09	83.10±83.43	0.594	0.554
Vitamin B12 (µg)	9.26±24.27	3.26±2.17	1.967	0.054
Vitamin A (µg)	2382.83±8301.76	1000.70±616.45	1.326	0.189
Vitamin C (mg)	108.95±125.9	113.82±125.65	-0.193	0.847
Cholesterol (mg)	352.93±365.11	342.56±190.97	0.167	0.867
Polyunsaturated fatty acid (g)	13.84±9.74	15.88±9.91	-1.039	0.301
Monounsaturated fatty acid (g)	32.58±66.59	30.23±13.64	0.223	0.824
Vitamin B1 (Thiamine) (mg)	0.79±0.35	1.09±0.49	-3.467	0.001*
Vitamin B2 (Riboflavin) (mg)	1.42±1.11	1.46±0.58	-0.252	0.801
Vitamin B6 (mg)	1.05±0.55	1.35±0.71	-2.435	0.017
Folate (µg)	283.27±171.08	340.45±138.47	-1.795	0.076
Sodium (mg)	4148.37±7377.51	4617.45±2515.63	-0.392	0.696
Potassium (mg)	2237.05±1312.10	2762.72±1469.29	-1.911	0.059
Calcium (mg)	648.46±291.38	860.92±423.33	-3.047	0.003*
Magnesium (mg)	264.18±150.15	349.17±154.05	-2.801	0.006*
Phosphorus (mg)	1004.76±576.54	1295.25±542.25	-2.577	0.011*
Iron (mg)	10.45±9.97	12.60±5.67	-1.255	0.212
Zinc (mg)	10.37±13.08	12.15±5.45	-0.826	0.410

Independent Sample T Test, *p<0,05

Table 5: Comparison of blood test results of patients according to gender

Blood test results	Women (n=64)	Men (n=41)	Reference range	t	p*
	Mean±SD	Mean±SD			
The fasting blood glucose (mg/dL)	101.81±23.12	106.61±50.33	70-105	-0.662	0.509
Alanine aminotransferase (ALT) (IU/L)	22.72±11.17	34.68±22.22	0-50	-3.198	0.002*
Aspartate aminotransferase (AST) (IU/L)	25.69±18.65	26.90±9.80	0-39	-0.384	0.702
Total cholesterol (mg/dL)	199.41±48.59	201.85±39.68	0-200	-0.270	0.788
LDL cholesterol (mg/dL)	124.88±40.43	136.68±52.87	0-160	-1.293	0.199
HDL cholesterol (mg/dL)	54.16±16.67	44.46±10.38	<40 (risk for male) <50 (risk for female)	3.672	<0.001*
Triglyceride (mg/dL)	111.48±55.63	156.24±193.53	35-150	-1.443	0.156
Vitamin D (ng/mL)	18.96±10.69	19.15±7.71	0-20 Deficiency 20-30 Insufficiency 30-100 Sufficiency >150 Toxic	-0.099	0.921

Independent Sample T Test, *p<0,05

DISCUSSION

In this study, we investigated the anthropometric measures, nutritional status, and eating habits of CHB patients. There was a total of 105 patients, and the mean age was 45.6 years. 64% of the patients were female, and more than half of all participants had completed only primary education. The mean BMI of the patients was 30.47 kg/m² and there was a statistically significant difference between the mean BMIs of females and males. One study from Pakistan evaluated the educational status of 100 HB patients and found that 71% were illiterate and only 1% had completed post-secondary education. They concluded that educational status was significantly associated with the risk of developing hepatitis B (11). These data suggest that HB may be more common among individuals who are poorly educated.

Waist circumference is an important indicator of visceral obesity and has been cited as a risk factor for numerous metabolic diseases. In one study, it was reported that CHB patients who had steatosis had higher BMI and waist circumference values compared to those who did not (12). Another study found that 67.7% of patients with HCV-associated NAFLD were obese, and 80.2% had a large waist circumference (13). In this study, we found that males were at risk and females at high risk of abdominal obesity. This also suggests that these patients are at risk for developing cardiovascular diseases. Obesity is also associated with an increased risk of cirrhosis-related hospitalization or death, as well as a higher risk of developing HCC (6). There are very few studies on the prevalence of steatosis in the setting of hepatitis B. One such study demonstrated that in CHB patients, steatosis was associated with the diagnostic criteria for metabolic syndrome, and BMI (14). In this study, we were able to access liver ultrasound results of 63 patients and we did not find a significant relationship between steatosis and BMI classes or waist-to-hip ratio. Among these 63 individuals, 68.2% had steatosis of various severity (grade 1 44.4%, grade 2 15.9%, 2 and grade 3 7.9%). A study on the prevalence of fatty liver in individuals with and without chronic hepatitis found that the prevalence of NAFLD was 13.5% in HB patients and 28.3% in the control group (15). The prevalence of fatty liver was quite high in our study, but this result may be due to not having accessed the ultrasound results of all patients. On the other hand, we found a positive correlation between BMI values and total cholesterol, LDL cholesterol and triglyceride values in female patients. Moreover, male patients had risky triglyceride and total cholesterol levels. Regarding the impact of HBV infection on the lipid profile, one study compared HBV patients with healthy individuals and observed elevated total cholesterol and LDL levels in patients with HBV infection (16). In our study, 15.7% of HB patients had been diagnosed with heart disease. In the 2010 report of the Turkish Nutrition and Health Survey, it is emphasized that a healthy, adequate and balanced diet should include no more than 300 mg of cholesterol intake every day (17). In our study, the cholesterol intake of both female and male patients significantly exceeded this recommended level. Excessive dietary cholesterol raises blood cholesterol levels and increases the risk of cardiovascular disease (17). This underlines the significance of adequate nutrition for patients chronically infected with HB in terms of cardiovascular diseases.

Another chronic disease associated with HB is diabetes. It has been shown that the prevalence of HB is higher among individuals with diabetes compared to non-diabetics (18). In addition, patients with chronic HBV infection have a higher risk of developing diabetes (19). In this study, 23% of patients had been diagnosed with diabetes. Another major factor in the development of diabetes is obesity, and therefore, adequate and balanced nutrition. Bodyweight management, as well as antiviral therapy, is essential for the management of HB (6). According to Turkey-Specific Food and Nutrition Guide

(TUBER), 55-60% of daily calorie intake should come from carbohydrates, 10-15% from protein, and 25-30% from fats (20). In this study, the percentage of energy from carbohydrates was below, and the percentage of energy from fat was above recommended levels for both sexes. This finding was ascribed to fad diets that promote food rich in proteins and fats and poor in carbohydrates.

Physical activity is a significant component of HBV treatment. Adequate physical activity can prevent the development of metabolic syndrome and weight gain and subsequently produce therapeutic effects. One study found that individuals with NAFLD were less physically active compared to healthy individuals (21). In our study, both male and female patients most commonly reported moderate physical activity. Hepatic disease is associated with an increased risk of early mortality. One study demonstrated that every 10 minutes of moderate to vigorous physical activity decreased mortality risk by 89% (22).

The limitations of our study are due to its retrospective nature, including the small sample size, incomplete ultrasound data, and lack of a healthy control group. Further larger controlled studies are needed.

CONCLUSION

To conclude, we found above-normal BMI values, and high dietary fat (%) and cholesterol consumption in both male and female CHB patients. In addition, males had borderline FBG, total cholesterol, and triglyceride levels, and both sexes were at risk for abdominal obesity. In reference to our findings, we conclude that it is essential to maintain an adequate and balanced diet in order to control body weight and prevent nutrition-related diseases in the setting of CHB.

ETHICAL DECLARATIONS

Ethics Committee Approval: This study was granted ethical approval by the İstanbul Okan University Non-Interventional Research Ethics Committee (Date 29.04.2020, Decision No: 56665618-204.01.07).

Informed Consent: Because the study was designed retrospectively, no written informed consent form was obtained from patients.

Referee Evaluation Process: Externally peer-reviewed.

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REFERENCES

1. European Association for the Study of the Liver. EASL 2017 Clinical Practice Guidelines on the management of hepatitis B virus infection. J Hepatology 2017; 67: 370-98.
2. World Health Organization. Global hepatitis report 2017. https://apps.who.int/iris/handle/10665/255016. License: CC BY-NC-SA 3.0 IGO. Accessed date: 17.05.2021.
3. Gerlich WH. Medical virology of hepatitis B: how it began and where we are now. Virol J 2013; 10: 1-25.
4. Toy M, Onder FO, Wormann T, et al. Age- and region-specific hepatitis B prevalence in Turkey estimated using generalized linear mixed models: a systematic review. BMC Infect Dis 2011; 11: 337.
5. Krajden M, McNabb G, Petric M. The laboratory diagnosis of hepatitis B virus. Can J Infect Dis Med Microbiol 2005; 16: 65-72.
6. Lee I-C, Huang Y-H, Chan C-C, et al. Impact of body mass index and viral load on liver histology in hepatitis B e antigen-negative chronic hepatitis B. Clin Nutr 2011; 30: 647-52.
7. Silva M, Gomes S, Peixoto A, et al. Nutrition in Chronic Liver Disease. GE Port J Gastroenterol 2015; 22: 268-76.
8. World Health Organization Europe, 2018. Body mass index-BMI. http://www. euro. who. int/en/health-topics/diseaseprevention/nutrition/a-healthy-lifestyle/body-mass-index-bmi. Accessed date: 03.08.2021.
9. World Health Organization. Waist circumference and waist-hip ratio: report of a WHO expert consultation, Geneva, 8-11 December 2008. https://apps.who.int/iris/handle/10665/44583. Accessed date: 03.08.2021.
10. International Physical Activity Questionnaire. IPAQ scoring protocol, 2005. https://www.physio-pedia.com/images/c/c7/Quidelines_for_interpreting_the_IPAQ.pdf. Accessed date: 03.08.2021.
11. Shafiq M, Nadeem M, Sattar Z, et al. Identification of risk factors for hepatitis B and C in Peshawar, Pakistan. HIV/AIDS (Auckl) 2015; 7: 223-31.
12. Hashimoto M, Tashiro H, Kobayashi T, Kuroda S, Hamaoka M, Ohdan H. Influence of higher BMI for hepatitis B-and C-related hepatocellular carcinomas. Langenbecks Arch Surg 2017; 402: 745-55.
13. Ferolla SM, Ferrari TC, Lima ML, et al. Dietary patterns in Brazilian patients with nonalcoholic fatty liver disease: a cross-sectional study. Clinics (Sao Paulo) 2013; 68: 11-7.
14. Peng D, Han Y, Ding H, Wei L. Hepatic steatosis in chronic hepatitis B patients is associated with metabolic factors more than viral factors. J Gastroenterol Hepatol 2008; 23: 1082-8.
15. Wong VW-S, Wong GL-H, Chu WC-W, et al. Hepatitis B virus infection and fatty liver in the general population. J Hepatol 2012; 56: 533-40.
16. Quaye O, Amuzu BG, Adadey SM, Tagoe EA. Effect of hepatitis B virus (HBV) infection on lipid profile in Ghanaian patients. Virology (Auckl) 2019; 10: 1178122X19827606.
17. Turkey nutrition and health survey 2010: Evaluation of nutritional status and habits, final report. Minister of Health 2014. https://hsgm.saglik.gov.tr/depo/birimler/saglikli-beslenme-hareketli-hayat-db/Yayinlar/kitaplar/diger-kitaplar/TBSA-Beslenme-Yayini.pdf. Accessed date: 19.05.2021
18. Schillie S, Xing J, Murphy T, Hu D. Prevalence of hepatitis B virus infection among persons with diagnosed diabetes mellitus in the United States, 1999–2010. J Viral Hepat 2012; 19: 674-6.
19. Cai C, Zeng J, Wu H, et al. Association between hepatitis B virus infection and diabetes mellitus: A meta-analysis. Exp Ther Med 2015; 10: 693-8.

20. Pekcan G, Şanlıer N, Baş M, et al. Turkey nutrition guide. 2015. https://dosyasb.saglik.gov.tr/Eklenti/10915,tuber-turkiye-beslenme-rehberipdf.pdf. Accessed date: 19.05.2021.

21. Hallsworth K, Thoma C, Moore S, et al. Non-alcoholic fatty liver disease is associated with higher levels of objectively measured sedentary behaviour and lower levels of physical activity than matched healthy controls. Frontline Gastroenterol 2015; 6: 44-51.

22. Loprinzi PD, VanWagner LB. Survival effects of physical activity on mortality among persons with liver disease. Prev Med Rep 2016; 3: 132-4.