Govaresh/ Vol.30/ No.4/ Winter 2026; 205-210

Original Article

Portal Vein Phasic Flow in Patients with Severe Fatty Liver without Cirrhotic Changes

Reza Naseri[1], Farshad Shohani[2*], Pooneh Dehghan[3], Mehdi Eshaghzadeh[3]

[1]Department of Radiology, Loghman Hakim Hospital, Shahid Beheshti University of Medical Sciences, Tehran, Iran

[2]School of Medicine, Shahid Beheshti University of Medical Sciences, Tehran, Iran

[3]Department of Radiology, Taleghani Hospital, Shahid Beheshti University of Medical Sciences, Tehran, Iran

ABSTRACT

Background:
Non-alcoholic fatty liver disease is the most common cause of liver diseases in many developed countries, leading to chronic liver disease.
Objectives: This study aimed to investigate the phasic flow of the portal vein in patients with severe fatty liver without cirrhotic changes.

Materials and Methods:
This cross-sectional study included 40 patients aged 18 years or older who were referred to Taleghani Hospital over the past year and underwent ultrasonography. In these patients, portal vein phasic flow in severe fatty liver (Grades 2 and 3) without cirrhotic changes was measured and quantified by ultrasonography. After identifying the samples, data collection was completed by performing an ultrasound and blood tests according to the study objectives. Data were analyzed using SPSS software version 25, and the significance level was set at $P < 0.05$.

Results:
55% of the cases were men, and 45% were women. Most of the study samples (92.5%) reported no disease. The Maximum Velocity) Vmax (distribution is mainly concentrated between 13 and 22; the presence of a very large value of 120 indicates a potential outlier and a significant effect on the mean. Minimum Velocity) Vmin) is mostly in the range of 10 to 14, and a value of 90 indicates a potential outlier.

Conclusion:
The present study showed no significant difference in frequency between the two sexes. The results also indicated that the maximum peak velocity, minimum peak velocity, mean flow velocity, portal vein pulsatility index, and hepatic artery resistance index were significantly lower in non-alcoholic fatty liver disease.
Keywords: Fatty liver, Portal vein, Ultrasound

please cite this paper as:
Naseri R, Shohani F, Dehghan P, Eshaghzadeh M. Portal Vein Phasic Flow in Patients with Severe Fatty Liver without Cirrhotic Changes. *Govaresh*. 2026; 30:205-210.

**Corresponding Author:*
Farshad Shohani
School of Medicine, Shahid Beheshti University of
Medical Sciences, Tehran, Iran
Tel: + 98 0021-23872220
Fax: + 98 0021-23872220
Email: shohanifarshad@gmail.com

Received: 01 Sep. 2025
Revised: 27 Dec. 2025
Accepted: 30 Dec. 2025

INTRODUCTION

Diseases are divided into two categories: chronic diseases and non-chronic diseases. Non-chronic diseases are a group of diseases that improve with healthy lifestyle changes, regular visits to the doctor, and adherence to treatment(1-4). Digestive diseases are among the important diseases and are caused by various reasons. These diseases are divided into different types, including cancer, surgical diseases of the digestive system, liver diseases, etc. (5-7). Liver diseases are among the related diseases, diabetes and obesity being of the causes of their occurrence (8).

Non-alcoholic fatty liver disease (NAFLD) is the hepatic manifestation of metabolic syndrome and the most common cause of liver diseases in many developed countries, leading to chronic liver disease. In patients with type 2 diabetes, the risk of progression to cirrhosis or hepatocellular carcinoma is doubled. The accumulation of liver fat can lead to a spectrum of symptoms ranging from simple steatosis to cirrhosis and even hepatocellular carcinoma due to the accumulation of fatty acids (9-12).

Non-alcoholic steatohepatitis (NASH) is the progression of NAFLD, characterized by hepatocyte damage, inflammation, liver fibrosis, and ultimately cirrhosis. DPP-IV (degrades a wide range of peptides), which is mainly expressed on the cell surfaces of endothelial cells and some lymphocytes, degrades a wide range of peptides. DPP-IV inhibitors stimulate insulin secretion in the absence of hypoglycemia or weight gain and appear to have preferential effects on postprandial blood glucose, but their effect on liver function and glucose metabolism in NAFLD is unclear. Sitagliptin and metformin reduce hemoglobin A1C (HbA1C) (13-15).

Most patients with fatty liver are between 40 and 60 years old, and the disease is more common in women. Fatty liver can also occur in children older than 10 years. This chronic liver disorder remains stable for years (15, 16). The diagnostic sensitivity of fatty liver disease with laboratory methods depends on the definition of the normal level of liver enzymes in serum (17). A study conducted in Iran on the general population showed that the normal levels of these enzymes in serum are lower than those reported by manufacturers of laboratory measurement tools. It seems that the normal range of liver enzymes should be determined and interpreted separately based on sex and weight (18-20). In other words, changing the normal serum level of liver enzymes alters the sensitivity of laboratory methods in diagnosing the disease (21, 22).

Symptoms of fatty liver disease include being asymptomatic, and it is incidentally discovered by elevated liver enzymes in blood tests performed for routine health checks or during an abdominal ultrasound performed for other reasons. Some patients rarely complain of vague upper right abdominal pain or early fatigue (20, 23, 24). The causes of the disease can be divided into two main groups: the first includes drugs and toxins, and the second includes metabolic disorders (22).

The aim of the present study was to investigate the phasic flow of the portal vein in patients with severe fatty liver (Grades 2 and 3) without cirrhotic changes who were referred to Taleghani Hospital in 2022-2023.

MATERIALS AND METHODS

This cross-sectional study included 40 patients aged 18 years or older who were referred to Taleghani Hospital over the past year and underwent ultrasonography. In these patients, portal vein phasic flow in severe fatty liver (Grades 2 and 3) without cirrhotic changes was measured and calculated using ultrasonography.

The target population consisted of patients who underwent ultrasonography for fatty liver in the Radiology Department of Taleghani Hospital. The study population included patients who underwent ultrasonography in the Radiology Department of Taleghani Hospital during the past year. The sample size was 40 patients.

The researcher adhered to the principles of the Helsinki Declaration throughout all stages of the research, and participants' information was used anonymously. Written informed consent was obtained from all participating patients in this study, and they were assured that their confidentiality would be maintained.

After data collection, the study information was entered into SPSS software version 25. For quantitative descriptive findings, the mean and standard deviation were used; for qualitative findings, frequency and percentage were used. The Kolmogorov-Smirnov test was used to assess the normality of quantitative data. Independent t-test, paired t-test, and ANOVA tests were used for inferential statistical analysis. The significance level was set at $P<0.05$.

RESULTS

Demographic information of the research samples is presented in Table 1: 55% of cases were men, and 45% were women. Most of the research samples (92.5%) reported no disease. The Vmax distribution is mainly concentrated between 13 and 22; the presence of a very large value of 120 indicates a potential outlier and a significant effect on the mean (Table 2). Analytical note: VMIN is mostly in the range of 10 to 14, and a value of 90 indicates a potential outlier (Table 3). The mean aspartate aminotransferase (AST) was approximately 67.8 (SD ≈ 45.4) with a range of 23 to 270; the presence of a value of 270 indicates a potential outlier. The mean Vmax of group

0 was higher, and its dispersion was large (due to outliers) (Table 4). Table 4 shows the Pearson correlation matrix ® — N=30. A very high correlation was observed between Vmax and Vmin (r ≈ 0.983) and a strong correlation between alanine aminotransferase (ALT) and AST (r ≈ 0.711). The correlation of ALT with Grade was moderate and positive (r ≈ 0.376). Other coefficients were small and often insignificant.

General note: No significant difference was observed between Grade levels in most variables. ALT showed a linear increase with Grade; it is suggested that if possible, missing data should be completed and sensitivity analyses performed for outliers (Vmax=120 and Vmin=90). The data in the present table were evaluated using advanced statistical methods (such as ANOVA and Pearson's correlation analysis). Given the effect size (η^2) and significance level (P value), it can be concluded that the observed differences in these variables were mostly statistically insignificant, except when a clear linear increasing trend was observed (e.g., ALT with respect to Grade). Such findings highlight the importance of investigating linear and non-linear relationships between physiological variables and clinical indicators and can serve as a basis for predictive modeling in future studies. Figure 1 fully illustrates the stratification of Vmin-Vmax by Grade and sex (Tables 3 and 4).

Table 1. Demographic Information of Research Samples

Variable	Category	Frequency	Valid percent
Sex	Male	22	55.0
	Female	18	45.0
Disease status	No	37	92.5
	Yes	3	7.5
Fatty liver grade status	0	11	27.5
	2	13	32.5
	3	16	40.0
Valid total	40		100.0

Table 2. Vmax and Vmin frequency

Status	Frequency	Valid percent	Cumulative percent	Status	Frequency	Valid percent	Cumulative percent
Vmax frequency				Vmin frequency			
10	1	2.5	2.5	**8**	2	5	5
11	1	2.5	5	**9**	2	5	10
12	2	5	10	**10**	4	10	20
13	5	12.5	22.5	**11**	6	15	35
14	5	12.5	35	**12**	5	12.5	47.5
15	5	12.5	47.5	**13**	5	12.5	60
16	1	2.5	50	**14**	3	7.5	67.5
17	2	5	55	**15**	1	2.5	70
18	4	10	65	**17**	2	5	75
19	3	7.5	72.5	**18**	1	2.5	77.5
21	2	5	77.5	**19**	2	5	82.5
22	4	10	87.5	**20**	2	5	87.5
23	1	2.5	90	**22**	1	2.5	90
26	1	2.5	92.5	**23**	1	2.5	92.5
27	1	2.5	95	**27**	1	2.5	95
34	1	2.5	97.5	**30**	1	2.5	97.5
120	1	2.5	100	**90**	1	2.5	100

Table 3. Descriptive statistics of Vmin - Vmax by Grade

Statistic		N	Mean	Standard deviation	Standard error	95% Confidence interval (lower)	95% Confidence interval (upper)	Minimum	Maximum
Vmax	Grade 0	11	27.09	31.15	9.39	6.17	48.02	13	120
	Grade 2	13	16.77	3.35	0.93	14.75	18.79	11	23
	Grade 3	16	17.38	6.25	1.56	14.05	20.70	10	34
	Total	**40**	**19.85**	**16.96**	**2.68**	**14.43**	**25.27**	**10**	**120**
Vmin	Grade 0	11	21.82	23.06	6.95	6.33	37.31	10	90
	Grade 2	13	13.15	3.18	0.88	11.23	15.08	8	20
	Grade 3	16	14.56	6.54	1.64	11.08	18.05	8	30
	Total	**40**	**16.10**	**13.00**	**2.06**	**11.94**	**20.26**	**8**	**90**

Table 4. Pearson correlation matrix (N=30)

Variables	Grade	Sex	Disease	Vmax	Vmin	BMI	AST	ALT
Grade	1.000	-0.104	0.234	0.012	-0.058	0.026	0.021	0.376
Sex	-0.104	1.000	-0.067	0.160	0.154	-0.063	-0.349	-0.378
Disease	0.234	-0.067	1.000	-0.077	-0.085	-0.098	-0.014	0.041
Vmax	0.012	0.160	-0.077	1.000	0.983	-0.427	-0.316	-0.393
Vmin	-0.058	0.154	-0.085	0.983	1.000	-0.439	-0.307	-0.379
BMI	0.026	-0.063	-0.098	-0.427	-0.439	1.000	0.121	0.153
AST	0.021	-0.349	-0.014	-0.316	-0.307	0.121	1.000	0.711
ALT	0.376	-0.378	0.041	-0.393	-0.379	0.153	0.711	1.000

DISCUSSION

Attention to gastrointestinal diseases, especially liver-related diseases, must be a research priority, and researchers should conduct important, applied studies in this field to improve patient health (25-27). The aim of this study was to investigate the phasic flow of the portal vein in patients with severe fatty liver (Grades 2 and 3) without cirrhotic changes, among patients referred to Taleghani Hospital in the 2022 –2023.

In a meta-analysis by Tabaeian and others, the results of nine articles concerning the prevalence of NAFLD in patients aged 6 to 18 years were analyzed. Of the nine studies, seven were assessed as having good quality and two as having moderate quality. The prevalence of NAFLD in the Iranian population was 35%, with a high heterogeneity of 99.3%. The reviewed studies were conducted in various cities across Iran, including Isfahan, Tabriz, Zahedan, Kashan, Shiraz, and Birjand. Ultrasonography was the diagnostic method used in all of them. Participants in five of the studies were of a normal/healthy weight status, while those in four studies were categorized as obese or significantly overweight (28). In the case-control study by Kohnaki and colleagues, 150 patients with NAFLD and 150 non-affected individuals were investigated. Individuals with a sonography-confirmed diagnosis or final physician confirmation of fatty liver were assigned to the case group, while those with normal sonography results were assigned to the control group. The levels of total cholesterol, triglycerides, AST, ALT, and low-density lipoprotein (LDL) were higher in the case group than in the control group. In contrast, the levels of high-density lipoprotein (HDL) and fasting blood sugar (FBS) did not differ significantly between the studied groups (29).

In a study by Behmaram and others, liver size and its relationship with the degree of fatty liver (NAFLD) grade were investigated. The study method was retrospective-prospective, and 100 patients were examined from June 2022 to June 2023. The examined patients were required to be aged 30 to 60 years, and AST and ALT tests were performed on all of them. Regarding patient grading, 33% had Grade 1 (mean 135.58), 34% had Grade 2 (mean 160.97), and 33% had Grade 3 (mean 148.27). Furthermore, a significant difference was observed between the patient categories based on fatty liver grade (30).

CONCLUSION

The present study showed no significant difference in frequency between the two sexes, and also indicated that the maximum peak velocity, minimum peak velocity, mean flow velocity, portal vein pulsatility index, and hepatic artery resistance index were significantly lower in NAFLD.

ACKNOWLEDGMENTS

Shahid Beheshti University of Medical Sciences, Tehran, Iran.

SUPPORT AND FUNDING

The study's ethical code was approved by the Ethics Committee of Shahid Beheshti University of Medical Sciences, Tehran, Iran. This article is the result of a specialized radiology thesis, under the ethical code (IR.SBMU.MSP.REC.1402.568). The authors of this article are grateful to all patients participating in the study and to the Research and Technology Deputy and the Ethics Committee of Shahid Beheshti University of Medical Sciences for their sincere cooperation.

CONFLICTS OF INTEREST:

The authors declare no conflict of interest related to this work.

REFERENCES:

1. Saiwan MJ, Al-showaily JS. Psycho-educational programs: Enhancing coping strategies and mitigating anxiety in chemotherapy patients. *Babcock University Medical Journal*. 2025;8(2):360-77.
2. Bakytbekovich ON, Al-Hili A, Hamid Ali D, Kamal Mahmoud A, Hachim Muhammad E, Abed A, et al. The effect of intervention using stages of change method to improve pap smear screening for cervical cancer. *J Obstet Gynecol Cancer Res*. 2023;8(3):277-84.
3. Al-Showaily JS, Saiwan MJ, Dawood MA, editors. Mothers of Autistic Children Insisting Needs. *Med Forum Month.*2025.
4. Borji M, Nourmohammadi H, Otaghi M, Salimi AH, Tarjoman A. Positive Effects of Cognitive Behavioral Therapy on Depression, Anxiety and Stress of Family Caregivers of Patients with Prostate Cancer: A Randomized Clinical Trial. *Asian Pac J Cancer Prev*. 2017;18(12):3207-12.
5. Borji M. Investigating the effect of home care on death anxiety in patients with gastrointestinal cancer. *Govaresh*. 2017;22(2):131-2.
6. Mehdi S, Behzad A, Aminollah V, Gholamreza E. Assessment of Chronic Postoperative Inguinal Hernia Pain (CPIP) in Children. *Arch Anesthesiol Crit Care*. 2025.
7. Mehdi S, Behzad A, Milad B, Gholamreza E. Risk Factors for Readmission after Appendectomy in Hospital. Arch Anesthesiol Crit Care.2025.
8. Mohajan D, Mohajan HK. Obesity and its related diseases: a new escalating alarming in global health. *J Inno Med Res*. 2023;2(3):12-23.
9. Abd El-Kader SM, El-Den Ashmawy EMS. Non-alcoholic fatty liver disease: The diagnosis and management. *World J Hepatol*. 2015;7(6):846.
10. Younossi ZM, Golabi P, Price JK, Owrangi S, Gundu-Rao N, Satchi R, et al. The global epidemiology of nonalcoholic fatty liver disease and nonalcoholic steatohepatitis among patients with type 2 diabetes. *Clin Gastroenterol Hepatol*.2024;22(10):1999-2010. e8.
11. Younossi ZM, Paik JM, Stepanova M, Ong J, Alqahtani S, Henry L. Clinical profiles and mortality rates are similar for metabolic dysfunction-associated steatotic liver disease and non-alcoholic fatty liver disease. *J Hepatol*. 2024;80(5):694-701.
12. Ghaemi A, Taleban F, Hekmatdoost A, Rafiei A, Hosseini V, Amiri Z, et al. Effect of weight reduction diet on non-alcoholic fatty liver disease. *Iran J Nutr Sci Food Technol*. 2013;8(2):123-34.
13. Shu X, Zhang L, Ji G. Vitamin E therapy in non-alcoholic fatty liver disease. *Int J Clin Med*. 2014;5(3):87-92.
14. Li J, Zhang Y, Ma X, Liu R, Xu C, He Q, et al. Identification and validation of cuproptosis-related genes for diagnosis and therapy in nonalcoholic fatty liver disease. *Molecul Cell Bioch*. 2025;480(1):473-89.
15. Polyzos SA, Mantzoros CS. Metabolic dysfunction-associated steatotic liver disease: Recent turning points for its diagnosis and management. *Metabol Clin Exper*. 2024;157.
16. Huh Y, Cho YJ, Nam GE. Recent epidemiology and risk factors of nonalcoholic fatty liver disease. *J Obes Metabol Synd.* 2022;31(1):17.
17. Ahmed A, Wong RJ, Harrison SA. Nonalcoholic fatty liver disease review: diagnosis, treatment, and outcomes. *Clin Gastroenterol Hepatol*. 2015;13(1)2062-70.
18. Younossi ZM, Golabi P, Paik JM, Henry A, Van Dongen C, Henry L. The global epidemiology of nonalcoholic fatty liver disease (NAFLD) and nonalcoholic steatohepatitis (NASH): a systematic review. *Hepatology*. 2023;77(4):1335-47.
19. Vachliotis ID, Valsamidis I, Polyzos SA. Tumor necrosis factor-alpha and adiponectin in nonalcoholic fatty liver disease-associated hepatocellular carcinoma. *Cancers*. 2023;15(21):5306.
20. Polyzos SA, Kountouras J, Zavos C, Tsiaousi E. The role of adiponectin in the pathogenesis and treatment of non-alcoholic fatty liver disease. *Diabetes, Obes Metabol*. 2010;12(5):365-83.
21. Cholongitas E, Pavlopoulou I, Papatheodoridi M, Markakis GE, Bouras E, Haidich AB, et al. Epidemiology of nonalcoholic fatty liver disease in Europe: a systematic review and meta-analysis. *Ann Gastroenterol*. 2021;34(3):404.
22. Sabry M, Youssef T, Shaker M, Salama MM, Assem N,

Anwar CA. Portal venous and hepatic artery hemodynamic variation in non-alcoholic fatty liver disease. *Egypt Liver J*. 2021;11(1):58.
23. Chung E. Pathogenesis and Therapeutic Considerations for Nonalcoholic Fatty Liver Disease. 2024.
24. Sharma P, Arora A. Clinical presentation of alcoholic liver disease and non-alcoholic fatty liver disease: spectrum and diagnosis. *Trans Gastroenterol Hepatol*.2020;5:19.
25. Hemmati B, Nakhaei S, Hoseini shamsabadi R. Evaluation of Prevalevce and Relative Risk Factors for Non-alcoholic Fatty Liver in Children Referred to Ultrasound Ward of Ali Asghar Hospital in Tehran 2019 to 2020. *Razi Journal of Medical Sciences.* 2024;31(1):1-9.
26. Ezenwuba B, Hynes C. Ultrasound screening of paediatric non-alcoholic fatty liver disease (NAFLD): A critical literature review. *Radiography*. 2024;30(5):1317-25.
27. D'Hondt A, Rubesova E, Xie H, Shamdasani V, Barth RA. Liver fat quantification by ultrasound in children: a prospective study. *Am J Roentgenol*. 2021;217(4):996-1006.
28. Tabaeian SP, Behzadifar M, Rezapour A, Azari S, Behzadifar M. Prevalence of non-alcoholic fatty liver disease among Iranians aged 6 to 18 years: a systematic review and meta-analysis. *Scientific Magazine Yafte.* 2023;25(1):59-70.
29. Moradi Kohnaki Z, Asadollahi K, Abangah G, Sayehmiri K. Risk factors of nonalcoholic fatty liver disease: a case-control study. *Tehran University Medical Journal*. 2016;74(9):645-56.
30. Behmaram M, Hanafi MG, Fakhri zadeh A, akhavan Sabagh M, Farhadi E. Evaluating the Correlation between Liver Size and Fatty Liver Progression in Patients with Non-Alcoholic Fatty Liver Disease. *Tehran University Medical Journal*. 2024;82(1):28-35.