Association of Non-Alcoholic Fatty Liver Disease and Chronic Kidney Disease in Egyptian Patients

Original Article

Sonya Ahmed Ali El Gaaly[1], Essam M Bayoumy[1], Marina Maurice Bebawy[2] and Ahmed M. F. Mansour[1]

[1]Gastroenterology and Hepatology Unit, Internal Medicine Department, Faculty of Medicine, Ain Shams University, Cairo, Egypt

[2]National Institute of Urology and Nephrology, Cairo, Egypt

ABSTRACT

Background: Non-alcoholic fatty liver disease (NAFLD) is considered an important global and public disease affecting millions of people worldwide. In contrast, the concept of chronic kidney disease (CKD) is still evolving from being a common consequence of different diseases into a spectrum of serious complications affecting multiple body organs. A surge of hypotheses and studies suggesting a possible link between NAFLD and CKD are currently emerging as an interesting area in the research field. Both CKD and NAFLD are considered serious disorders leading to many complications and leading to high economic burdens across the globe.

Aim of the Work: This study aimed at assessing the association between CKD and NAFLD in Egyptian patients.

Results: Our study reported a highly significant statistical difference among NAFLD and non-NAFLD groups as regard CKD stages, although a non-significant difference was reported between study groups as regard estimated glomerular filtration rate (eGFR). Also, a statistically significant difference was shown between both groups as regard obesity and hypertension, in addition to a highly significant difference as regard metabolic syndrome (MetS). In contrast, there was a non-significant statistical difference between both groups as regard the development of diabetes mellitus (DM).

Conclusion: NAFLD, together with different co-morbid conditions, is associated with the possibility of development of CKD. We recommend careful assessment of NAFLD patients, especially those with co-existing comorbidities, for the development of CKD. Future studies should focus on the possible risk factors, etiological mechanisms and potential therapeutic targets for both NAFLD and CKD in a co-morbid situation.

Key Words: Chronic kidney disease, CKD, glomerular filtration rate, non-alcoholic fatty liver disease, NAFLD.

Received: 11 February 2025, **Accepted:** 2 March 2025.

Corresponding Author: Ahmed M. F. Mansour, Gastroenterology and Hepatology Unit, Internal Medicine Department, Faculty of Medicine, Ain Shams University, Cairo, Egypt., **Tel.:** +2 011 591 55 992, **E-mail**: ahmad_magdy@med.asu.edu.eg

ISSN: 2735-3540, Vol. 76, No. 2, June 2025.

INTRODUCTION

CKD was generally defined as gradual decline in renal function for at least three months which is evidenced through a decline in glomerular filtration rate (eGFR). It is considered a serious consequence of many diseases that is associated with a high economic burden of dialysis, morbidity, mortality, and poor quality of life[1].

NAFLD is considered a general term covering a wide spectrum of chronic liver diseases including simple hepatic steatosis, steatohepatitis, liver fibrosis, liver cirrhosis, and hepatocellular carcinoma. NAFLD and non-alcoholic steatohepatitis (NASH) are considered common manifestations of MetS, which in turn is considered a significant etiology for a wide spectrum of co-morbidities, including hypertension, DM, CKD, as well as increased risk of malignancy[2].

Recently, evidence have shown that CKD & NAFLD share many different etiopathogenic mechanisms and may have a complex mutual relationship[3]. Moreover, many studies have shown that NAFLD prevalence was found to be higher in CKD patients, including an Egyptian study which reported that 56% of CKD non-diabetic patients on regular hemodialysis, in addition to CKD pre-dialysis patients were diagnosed as NAFLD patients[4]. These observations further suggest that CKD patients with manifestations of MetS should routinely undergo screening for NAFLD[5].

DOI: 10.21608/ASMJ.2025.359988.1388

AIM OF THE WORK

The current study aimed at assessing the association between CKD & NAFLD in Egyptian patients.

PATIENTS AND METHODS

This was a cross-sectional retrospective study conducted on CKD patients at the outpatient clinics and inpatient wards of Ain Shams university hospitals, Cairo, Egypt.

Assessment of GFR was done using the Modification of Diet in Renal Disease (MDRD) equation. CKD was defined as eGFR <60mL/min/1.73m^2 and/or urinary albumin-creatinine ratio (ACR) ≥3 mg/mmol. Recent guidelines from Kidney Disease Improving Global Outcomes (KDIGO) consensus were used to define CKD stages as follows: stage 1: ACR ≥3 mg/mmol with eGFR ≥90 mL/min/1.73m^2, stage 2: ACR ≥3 mg/mmol with eGFR of 60–89 mL/min/1.73 m^2, stage 3: eGFR of 30–59 mL/min/1.73 m^2 (with or without ACR ≥3 mg/mmol), stage 4: eGFR of 15– 29 mL/min/1.73 m^2, and stage 5: eGFR <15 mL/ min/1.73 m^2 [6].

Patients with missing creatinine data, inadequate imaging, HBV or HCV co-infection, alcohol intake, and patients with incomplete laboratory or clinical information were not included in the study. All data of included subjects was revised in detail as regard demographic and anthropometric data including BMI and blood pressure, in addition to clinical and laboratory data.

NAFLD was diagnosed through pelvi-abdominal ultrasound based on detection of at least two of the following findings: a. Increased echogenicity of the liver parenchyma as compared to the spleen or kidney parenchyma; b. Attenuation of ultrasound beam; c. Poorly visualized intrahepatic structures[6].

Non-invasive methods were used to assess liver fibrosis severity:

- The NAFLD Fibrosis Score (NFS): The upper and lower cut-off values for NFS were −1.455 and 0.676, respectively[7].
- APRI Score: APRI score cut-off values were ≤0.5 and >1.5[8].

RESULTS

This study included 160 CKD patients, including 126 males (78.8%) and 34 females (21.2%) with ages ranging from 20 to 70 years (mean 54.56 years), a mean BMI of 25.53±2.52 kg/m^2 and a mean waist circumference of 90.06±7.94 cm.

The current study showed there were 79 (49.4%) cases with NAFLD and 81 (50.6%) cases without NAFLD. Among the non-NAFLD group, the majority (64.2%) had grade I CKD, followed by grade II (27.2%) and grade III (8.6%). On the other hand, among the NAFLD group, grade I CKD accounted for 21.5% of cases, grade II 41.8% and grade III 36.7%. Moreover, there were 78 (48.8%) cases with hypertension, 37 (23.1%) cases were DM, 28 (17.5%) cases with MetS, and 6 (3.8%) cases with obesity.

The eGFR in this study ranged from 11 to 95 (mean 57.59 ± 28.07), the mean BUN was 106.18 ± 17.40, the mean creatinine was 6.43 ± 1.55 and the mean uric acid was 3.69 ± 0.56.

As regard FIB-4 score, it ranged from 0.22 to 7 (mean 1.89 ± 1.78) and the NFS scores ranged from -3 to 0.15 (mean -1.65 ± 1.12).

There was a non-significant statistical difference among both study groups regarding age, but there was a highly significant statistical difference between both groups as regard BMI and waist circumference.

Additionally, the results showed a highly significant statistical difference among both study groups as regard CKD stages, and a significant statistical difference as regard obesity and hypertension.

As regard renal functions. there was a non-significant statistical difference among both groups as regard eGFR, BUN, and serum creatinine, while there was highly significant statistical difference as regard urinary ACR and uric acid.

DISCUSSION

CKD is now considered as a significant global disease leading to higher risk of cardiovascular morbidity and mortality, in addition to increased risk of hospitalization and dialysis. Several studies have shown a prevalence of CKD to be approximately 13% in the adult population. However, recently, there has been a dramatic worldwide increase in the prevalence of end-stage renal disease (ERSD) due to improved quality of medical care in addition to availability of different dialysis techniques. Many studies reported a rise in the numbers of ESRD patients on chronic dialysis in the past thirty years[9]. As a result, preventive plans against CKD is urgently needed to reduce the rise in numbers of ESRD patients, with subsequent economic burdens, and significant effects on quality of life.

CKD is now considered as a prominent risk factor for ERSD, as well as for cardiovascular disease, even during early stages of decline in renal function[10]. Hence, identification of different CKD risk factors is urgently needed for adequate prevention of its development

and further progression, early diagnosis, and prompt management.

In addition to CKD, NAFLD is now considered to be one of the most common chronic liver diseases, representing a significant health problem worldwide, affecting the quality of lives of millions of people around the globe. It has been estimated that 20-30% of the general population worldwide suffer from NAFLD[11].

NAFLD is considered a general term covering a wide range of chronic hepatic conditions, ranging from simple hepatic steatosis, NASH, liver fibrosis and cirrhosis, in addition to the risk for hepatocellular carcinoma. In addition, NAFLD is also considered as a significant risk factor for cardiovascular disease. Moreover, NAFLD is known to be closely linked to obesity and is considered an important component of MetS in the liver[12].

MetS different components including hypertension, dyslipidemia, DM, as well as obesity are also considered important risk factors leading to possible development and further progression of CKD. The possibility of presence of an interlink between NAFLD and CKD has recently been an interesting research focus point since NAFLD is frequently accompanied by different CKD risk factors, including insulin resistance, type 2 DM, truncal obesity, and MetS. Moreover, it was found that NAFLD can in itself possibly increase the incidence of CKD[13]. There are no enough studies to elucidate whether the link between NAFLD and CKD is mediated through common risk factors and etiopathological mechanisms, or whether NAFLD can by itself contribute to increasing CKD risk[14]. Thus, this study aimed at assessing the prevalence and possible association of NAFLD and CKD in Egyptian patients.

This was a retrospective cross-sectional study that was conducted on CKD patients at our institution inpatient wards and outpatient clinics. In the current study, out of 160 cases with CKD, 79 (49.4%) had NAFLD, while 81 (50.6%) didn't. Among the non-NAFLD group, the majority (64.2%) had grade I CKD, followed by grade II (27.2%) and grade III (8.6%). On the other hand, among the NAFLD group, grade I CKD accounted for 21.5% of cases, grade II 41.8% and grade III was 36.7%. These previous results disclosed that NAFLD was associated with more advanced stage of renal affection, raising the possibility for an interlink between the two conditions.

These results agree with a previous work by ***Cao et al.*** who aimed to evaluate the possible association between different comorbidities occurring with NAFLD together with the risk for CKD and abnormal albuminuria. Moreover, several recent studies have reported that the prevalence of CKD in NAFLD patients ranged from 4-42%[15,16]. Also, a recent cross-sectional study including 37,825 cases showed that CKD accounted for 17.5% of NAFLD patients in Taiwanese health check-up centers[17].

The present study showed a highly significant statistical difference among both study groups as regard BMI and waist circumference, which agrees with the recent work of Akahane and his colleagues[14]. This is also in harmony with ***Cao et al.*** who reported that, male patients with higher BMI and waist circumference were more likely to develop NAFLD than those with no such risk factors[7].

The current study also reported a highly significant statistical difference among both study groups as regard CKD stages. This is similar to a study by ***Cao et al.*** who reported a higher prevalence and progression of CKD in NAFLD patients than in those without NAFLD[7].

In a similar context, a recent meta-analysis by Musso and colleagues, which included 28,680 individuals from 11 studies have reported that NAFLD was associated with a highly increased risk of incident CKD[3]. Moreover, another updated meta-analysis that included 9 studies with 96,595 adult individuals, of whom 34.1% had NAFLD, reported an increased incidence of CKD in NAFLD patients, and the study results showed that the risk for developing CKD increased with more advanced NAFLD or liver fibrosis[18]. Another recent meta-analysis including 1,222,032 individuals, of whom 28.1% had NAFLD, in addition to 33,840 CKD patients with CKD stage 3 or above over a median follow-up period of 9.7 years indicated that NAFLD was associated with about 1.45-fold increased long-term risk of incident CKD stage 3 or above, and the risk seems to be positively correlated with NAFLD severity[19].

As regard NAFLD and DM, a previous study by ***Targher et al.,*** in addition to other studies, have showed that 40% of NAFLD patients with DM developed CKD[20,21]. Furthermore, another study by ***Zhao et al.*** who focused on the interlink between CKD & NAFLD in type 2 diabetic patients, have reported that type 2 DM and NAFLD were higher in CKD versus non-CKD patients[22].

Recently, several recent studies have reported the potential effects of NAFLD on the incidence and development of cardiovascular events (CVEs), increased mortality risk, in addition to progression of kidney disease in CKD patients[23–25].

Adipokines have also been a potential target for research, where several recent studies have showed their possible role in both NAFLD and CKD. Similarly, studies have shown that leptin was found to be related to increased NAFLD severity and increased risk of development and progression of CKD[26,27].

Recently, a study have shown that NAFLD population was associated with a two-fold increase in the incidence and prevalence of CKD compared with non-NAFLD population. Furthermore, the reported incidence and prevalence of CKD were also higher in NASH patients

than in those with NAFLD[28]. Nevertheless, several studies strongly suggest the presence of a two-way relationship between CKD and NAFLD[29,30]. Thus, some recent studies have reported that CKD could possibly increase the risk for development and progression of NAFLD[31].

In the same context, a recent study reported a significant, positive association between NAFLD and CKD, although this association was weakened after adjustment for features of MetS[15]. Similarly, another Taiwanese reported that moderate to severe NAFLD was significantly associated with CKD after adjustment for age, gender, smoking history, MetS, and serum ALT levels. However, this association was not observed in cases with mild NAFLD[17].

Moreover, another recent study reported that NAFLD was associated with a significantly increased risk of CKD compared with those without NAFLD. However, the inclusion of data without adjustment for risk factors for cardio-renal affection, as well as those without a valid control group, may overestimate the association between NAFLD and CKD[32]. Also, a recent meta-analysis found that NAFLD patients had a higher risk of incident CKD than those without NAFLD. However, this association between NAFLD and the risk of incident CKD was only observed in Asian populations, but not in European populations[18].

In contrast to the above data, a recent study failed to prove any significant relation between CKD and NAFLD[33]. Moreover, a study by ***Akahane et al.*** reported that CKD prevalence didn't differ between NAFLD and non-NAFLD patients, even after accounting for variability in age, gender, and components of MetS, concluding that NAFLD is not considered a significant independent risk factor for development of CKD[14].

Our study revealed a significant statistical difference among study groups as regard obesity and hypertension, in addition to a highly significant statistical difference as regard MetS. However, no significant statistical difference was reported among study groups as regard DM.

This comes in harmony with a recent study by Cao and colleagues who reported a significant difference among study groups as regard prevalence of CKD and abnormal albuminuria, after accounting for differences in age, gender, in addition to different components of MetS[7]. Also, another work by ***Akahane et al.*** proved an independent association between NAFLD co-morbidities such as hypertension and obesity on one hand and the prevalence of CKD on the other hand. Nevertheless, in their study, there was no association between DM and CKD in NAFLD together with non-NAFLD groups[14].

In this study, NAFLD group showed that 7.6% of patients were obese, 29.1% had DM, 57.0% had hypertension and 27.8% showed features of MetS.

NAFLD is considered to occur mainly in obese patients. Moreover, components of MetS was found to be more prevalent in NAFLD patients, in addition to increasing the risk of development of NAFLD[34].

Several recent studies have pointed out the role of NAFLD in promotion of dyslipidemia, and exacerbation of insulin resistance, in addition to its possible role in the production of pro-inflammatory cytokines that further enhance the development and progression of CKD[35,36].

Dyslipidemia is considered a prominent risk factor for development of NAFLD and CKD. This was shown in a recent study in which low levels of LDL and TG was found to be associated with reduced risk of progression of proteinuria from moderate to severe levels[37]. NAFLD patients usually show manifestation of IR, leading to disturbance on lipid metabolism. This can subsequently lead to ectopic accumulation of lipids in the kidney ending in lipotoxicity, which can further promote podocyte and renal tubular injury, leading to further progression of CKD[38].

Recently, several studies have shown a possible relation between obesity, NAFLD, and CKD, with BMI known to be positively correlated with the incidence and progression of kidney disease[39,40]. Obesity may lead to both NAFLD and CKD[41].

In our study, there was a non-significant statistical difference among both study groups as regard eGFR. These results comes in accordance with another recent study by Salford which reported a non-significant trend as regard CKD progression in NAFLD patients in comparison to non-NAFLD patients. It also stated that there was no observed differences between study groups as regard the incidence of ESRD[24].

However, the previous results disagree with another study by Zhao and colleagues who reported that NAFLD patients showed more decline in eGFR level in comparison to non-NAFLD patients[22]. The previous findings were reinforced by the results of another study by the Korean group which reported that patients with CKD and NAFLD showed more annual percentage decline in eGFR compared with non-NAFLD CKD patients[23].

In the present study, a highly significant statistical difference was shown among NAFLD and non-NAFLD groups as regard ALT, AST, urinary ACR, albumin and glycated hemoglobin. This agrees with Cao and colleagues' study which reported that NAFLD patients showed higher rates of abnormal albuminuria than non-NAFLD patients. In their study, NAFLD was found to be associated with increased risk of CKD and abnormal albuminuria, regardless of cardiac and metabolic risk factors. Moreover, a greater severity of NAFLD was strongly correlated with a higher risk for CKD and abnormal albuminuria. It was also

reported that NAFLD patients with MetS showed higher prevalence of CKD and abnormal albuminuria[7].

Our results also come in accordance with a recent study by ***Zhao et al.*** who reported that NAFLD patients showed higher serum creatinine and urinary ACR levels and lower eGFR levels when compared to non-NAFLD patients. Additionally, higher urinary ACR levels was significantly correlated to the prevalence and risk of NAFLD[22].

Several recent studies have reported hyperuricemia as an independent risk factor for the development and progression of CKD[42]. Recent studies conducted on hypertensive patients have shown that hyperuricemia was associated with more prevalence in CKD, including NAFLD patients[43]. Furthermore, recent studies have shown that hyperuricemia is considered an important risk factor for development of obesity and has a significant correlation with degree and severity of inflammation of hepatic lobules in NAFLD patients[44].

Several studies have recently reported the positive benefits of applying dietary and lifestyle modifications for NAFLD patients and have shown that improved NAFLD histology was associated with improved kidney function[45].

In the present study, there was highly significant statistical difference among NAFLD and non-NAFLD groups as regard cholesterol, TG, LDL, and HDL. This slightly agrees with a recent study which reported that total cholesterol, TG, and HDL were found to be significantly higher in NAFLD than in non-NAFLD patients[7]. Moreover, a recent study have showed that CKD patients with NAFLD had higher TG and VLDL levels than those without NAFLD, which suggested the possible role of lipid profile in the interaction between NAFLD and CKD[46].

In the current study, a significant statistical difference was shown among both study groups as regard FIB-4 and NFS scores, which comes in accordance with another study which reported that increased severity of NAFLD-associated liver fibrosis, based on non-invasive assessment modalities, also increased the rates of incidence and progression of CKD[47].

CONCLUSION

NAFLD and CKD show a mutual interlinked relationship. NAFLD, together with its associated comorbidities, including MetS, is considered and important predisposing factor for the development and progression of CKD. NAFLD patients should be advised to undergo meticulous regular follow up of kidney functions and eGFR for early detection and management of CKD. Future large-scale studies should focus on the possible risk factors, etiopathological mechanisms, and available therapeutic modalities that target both NAFLD and CKD.

LIST OF ABBREVIATIONS

ACR: Albumin-Creatinine ratio

CI: Confidence interval

CKD: Chronic kidney disease

CVEs: Cardiovascular events

DM: Diabetes mellitus

GFR: Glomerular filtration rate

eGFR: Estimated glomerular filtration rate

ESRD: End-stage renal disease

HDL: High-density lipoprotein

HR: Hazard ratio

IR: Insulin resistance

KDIGO: Kidney Disease Improving Global Outcomes

LDL: Low-density lipoprotein

MDRD: Modification of Diet in Renal Disease

MetS: Metabolic syndrome

NAFLD: Non-alcoholic fatty liver disease

NASH: Non-alcoholic steatohepatitis

NFS: NAFLD fibrosis score

OR: Odds ratio

TG: Serum triglycerides

VLDL: Very low-density lipoprotein

DECLARATIONS ETHICS APPROVAL

This study was performed in accordance with the institutional standards of the research ethics committee of Ain Shams University (Reference Number: FMASU MS 39/2023).

COMPETING INTERESTS

The authors declare that they have no competing interests.

FUNDING

Not applicable.

AUTHORS' CONTRIBUTIONS

EB formulated the main research idea and hypothesis, SE prepared the study design, shared in interpretation of collected data, and shared in revision of the manuscript, MB collected the research samples and data, AM shared in interpretation and analysis of collected data and drafted the manuscript. All authors have read and approved the final manuscript.

ACKNOWLEDGEMENTS

Not applicable.

REFERENCES

1. **Wilson S, Mone P, Jankauskas SS, Gambardella J, Santulli G.** Chronic kidney disease: Definition, updated epidemiology, staging, and mechanisms of increased cardiovascular risk. The Journal of Clinical Hypertension [Internet]. 2021 Apr 1 [cited 2023 Jul 11];23(4):831. Available from: /pmc/articles/PMC8035205/

2. **Heda R, Yazawa M, Shi M, Satapathy SK, Bhaskaran M, Aloor FZ, *et al.*** Non-alcoholic fatty liver and chronic kidney disease: Retrospect, introspect, and prospect. World J Gastroenterol [Internet]. 2021 May 5 [cited 2023 Jul 12];27(17):1864. Available from: /pmc/articles/PMC8108029/

3. **Musso G, Cassader M, Cohney S, Pinach S, Saba F, Gambino R.** Emerging Liver-Kidney Interactions in Nonalcoholic Fatty Liver Disease. Trends Mol Med [Internet]. 2015 Oct 1 [cited 2023 Jul 12];21(10):645–62. Available from: https://pubmed.ncbi.nlm.nih.gov/26432021/

4. **Behairy MA, Sherief AF, Hussein HA.** Prevalence of non-alcoholic fatty liver disease among patients with non-diabetic chronic kidney disease detected by transient elastography. Int Urol Nephrol [Internet]. 2021 Dec 1 [cited 2023 Jul 12];53(12):2593–601. Available from: https://link.springer.com/article/10.1007/s11255-021-02815-9

5. **Nagy J, Kovács T.** A brief review on the rising incidence of chronic kidney diseases and non-alcoholic fatty liver disease. Physiol Int [Internet]. 2019 Dec 1 [cited 2023 Jul 12];106(4):305–10. Available from: https://akjournals.com/view/journals/2060/106/4/article-p305.xml

6. **Choe AR, Ryu DR, Kim HY, Lee HA, Lim J, Kim JS, *et al.*** Noninvasive indices for predicting nonalcoholic fatty liver disease in patients with chronic kidney disease. BMC Nephrol [Internet]. 2020 Feb 17 [cited 2023 Jul 12];21(1). Available from: https://pubmed.ncbi.nlm.nih.gov/32066395/

7. **Cao Y, Deng Y, Wang J, Zhao H, Zhang J, Xie W.** The association between NAFLD and risk of chronic kidney disease: a cross-sectional study. Ther Adv Chronic Dis [Internet]. 2021 [cited 2023 Jul 12];12. Available from: /pmc/articles/PMC8586173/

8. **Ballestri S, Mantovani A, Baldelli E, Lugari S, Maurantonio M, Nascimbeni F, *et al.*** Liver Fibrosis Biomarkers Accurately Exclude Advanced Fibrosis and Are Associated with Higher Cardiovascular Risk Scores in Patients with NAFLD or Viral Chronic Liver Disease. Diagnostics (Basel) [Internet]. 2021 Jan 1 [cited 2023 Jul 12];11(1). Available from: https://pubmed.ncbi.nlm.nih.gov/33435415/

9. **Weng SC, Wu CL, Kor CT, Chiu PF, Wu MJ, Chang CC, *et al.*** Migraine and subsequent chronic kidney disease risk: a nationwide population-based cohort study. BMJ Open [Internet]. 2017 Dec 1 [cited 2023 Sep 11];7(12):e018483. Available from: https://bmjopen.bmj.com/content/7/12/e018483

10. **Sarnak MJ, Levey AS, Schoolwerth AC, Coresh J, Culleton B, Hamm LL, *et al.*** Kidney disease as a risk factor for development of cardiovascular disease: a statement from the American Heart Association Councils on Kidney in Cardiovascular Disease, High Blood Pressure Research, Clinical Cardiology, and Epidemiology and Prevention. Circulation [Internet]. 2003 Oct 28 [cited 2023 Sep 11];108(17):2154–69. Available from: https://pubmed.ncbi.nlm.nih.gov/14581387/

11. **Targher G, Chonchol M, Zoppini G, Abaterusso C, Bonora E.** Risk of chronic kidney disease in patients with non-alcoholic fatty liver disease: is there a link? J Hepatol [Internet]. 2011 May [cited 2023 Sep 11];54(5):1020–9. Available from: https://pubmed.ncbi.nlm.nih.gov/21145850/

12. **Niederseer D, Wernly S, Bachmayer S, Wernly B, Bakula A, Huber-Schönauer U, *et al.*** Diagnosis of Non-Alcoholic Fatty Liver Disease (NAFLD) Is Independently Associated with Cardiovascular Risk in a Large Austrian Screening Cohort. J Clin Med [Internet]. 2020 Apr 1 [cited 2023 Sep 11];9(4):1065. Available from: /pmc/articles/PMC7230765/

13. **Park H, Dawwas GK, Liu X, Nguyen MH.** Nonalcoholic fatty liver disease increases risk of incident advanced chronic kidney disease: a propensity-matched cohort study. J Intern Med [Internet]. 2019 Dec 1 [cited 2023 Sep 11];286(6):711–22. Available from: https://pubmed.ncbi.nlm.nih.gov/31359543/

14. **Akahane T, Akahane M, Namisaki T, Kaji K, Moriya K, Kawaratani H, *et al.*** Association between Non-Alcoholic Fatty Liver Disease and Chronic Kidney Disease: A Cross-Sectional Study. Journal of Clinical Medicine 2020, Vol 9, Page 1635 [Internet]. 2020 May 28 [cited 2023 Sep 11];9(6):1635. Available from: https://www.mdpi.com/2077-0383/9/6/1635/htm

15. **Sirota JC, McFann K, Targher G, Chonchol M, Jalal DI.** Association between Non-Alcoholic Liver Disease and Chronic Kidney Disease: An Ultrasound Analysis from NHANES 1988–1994. Am J Nephrol [Internet]. 2012 Nov [cited 2023 Oct 2];36(5):466. Available from: /pmc/articles/PMC3563287/

16. **Sun K, Lin D, Li F, Qi Y, Feng W, Yan L, *et al.*** Fatty liver index, albuminuria and the association with chronic kidney disease: a population-based study in China. BMJ Open [Internet]. 2018 Jan 1 [cited 2023 Oct 2];8(1):19097. Available from: /pmc/articles/PMC5829809/

17. **Liu HW, Liu JS, Kuo KL.** Association of nonalcoholic fatty liver and chronic kidney disease: An analysis of 37,825 cases from health checkup center in Taiwan. Tzu-Chi Medical Journal [Internet]. 2020 Jan 1 [cited 2023 Oct 2];32(1):65. Available from: /pmc/articles/PMC7015019/

18. **Mantovani A, Zaza G, Byrne CD, Lonardo A, Zoppini G, Bonora E, *et al.*** Nonalcoholic fatty liver disease increases risk of incident chronic kidney disease: A systematic review and meta-analysis. Metabolism [Internet]. 2018 Feb 1 [cited 2023 Oct 2];79:64–76. Available from: http://www.metabolismjournal.com/article/S0026049517303062/fulltext

19. **Mantovani A, Petracca G, Beatrice G, Csermely A, Lonardo A, Schattenberg JM, *et al.*** Non-alcoholic fatty liver disease and risk of incident chronic kidney disease: an updated meta-analysis. Gut [Internet]. 2022 Jan 1 [cited 2023 Oct 2];71(1):156–62. Available from: https://gut.bmj.com/content/71/1/156

20. **Targher G, Pichiri I, Zoppini G, Trombetta M, Bonora E.** Increased prevalence of chronic kidney disease in patients with Type 1 diabetes and non-alcoholic fatty liver. Diabet Med [Internet]. 2012 Feb [cited 2023 Oct 2];29(2):220–6. Available from: https://pubmed.ncbi.nlm.nih.gov/21883436/

21. **Yun HR, Kim H, Park JT, Chang TI, Yoo TH, Kang SW, *et al.*** Obesity, Metabolic Abnormality, and Progression of CKD. American Journal of Kidney Diseases [Internet]. 2018 Sep 1 [cited 2023 Oct 2];72(3):400–10. Available from: http://www.ajkd.org/article/S0272638618305973/fulltext

22. **Zhao P, Yan J, Pan B, Liu J, Fu S, Cheng J, *et al.*** Association Between the Risk of Non-Alcoholic Fatty Liver Disease in Patients with Type 2 Diabetes and Chronic Kidney Disease. Diabetes Metab Syndr Obes [Internet]. 2022 [cited 2023 Oct 6];15:1141. Available from: /pmc/articles/PMC9015107/

23. **Chinnadurai R, Ritchie J, Green D, Kalra PA.** Non-alcoholic fatty liver disease and clinical outcomes in chronic kidney disease. Nephrol Dial Transplant [Internet]. 2019 Mar 1 [cited 2023 Oct 2];34(3):449–57. Available from: https://pubmed.ncbi.nlm.nih.gov/29390103/

24. **Jang HR, Kang D, Sinn DH, Gu S, Cho SJ, Lee JE, *et al.*** Nonalcoholic fatty liver disease accelerates kidney function decline in patients with chronic kidney disease: a cohort study. Sci Rep [Internet]. 2018 Dec 1 [cited 2023 Oct 2];8(1). Available from: /pmc/articles/PMC5856790/

25. **Paik J, Golabi P, Younoszai Z, Mishra A, Trimble G, Younossi ZM.** Chronic kidney disease is independently associated with increased mortality in patients with nonalcoholic fatty liver disease. Liver International [Internet]. 2019 Feb 1 [cited 2023 Oct 2];39(2):342–52. Available from: https://onlinelibrary.wiley.com/doi/full/10.1111/liv.13992

26. **Tesauro M, Mascali A, Franzese O, Cipriani S, Cardillo C, Di Daniele N.** Chronic Kidney Disease, Obesity, and Hypertension: The Role of Leptin and Adiponectin. Int J Hypertens [Internet]. 2012 [cited 2023 Oct 6];2012. Available from: /pmc/articles/PMC3540814/

27. **Shabani P, Emamgholipour S, Doosti M.** CTRP1 in Liver Disease. Adv Clin Chem [Internet]. 2017 Dec 1 [cited 2023 Oct 6];79:1–23. Available from: https://pubmed.ncbi.nlm.nih.gov/28212710/

28. **Yang L, Chu TK, Lian J, Lo CW, Lau PK, Nan H, *et al.*** Risk factors of chronic kidney diseases in Chinese adults with type 2 diabetes. Sci Rep [Internet]. 2018 Dec 1 [cited 2023 Oct 6];8(1). Available from: /pmc/articles/PMC6168551/

29. **Lee YJ, Wang CP, Hung WC, Tang WH, Chang YH, Hu DW, *et al.*** Common and Unique Factors and the Bidirectional Relationship Between Chronic Kidney Disease and Nonalcoholic Fatty Liver in Type 2 Diabetes Patients. Diabetes Metab Syndr Obes [Internet]. 2020 [cited 2023 Oct 6];13:1203. Available from: /pmc/articles/PMC7173841/

30. **Targher G, Bertolini L, Rodella S, Zoppini G, Lippi G, Day C, *et al.*** Non-alcoholic fatty liver disease is independently associated with an increased prevalence of chronic kidney disease and proliferative/laser-treated retinopathy in type 2 diabetic patients. Diabetologia [Internet]. 2008 Mar [cited 2023 Oct 6];51(3):444–50. Available from: https://pubmed.ncbi.nlm.nih.gov/18058083/

31. **Cojocariu C, Singeap AM, Girleanu I, Chiriac S, Muzica CM, Sfarti CV, *et al.*** Nonalcoholic Fatty Liver Disease-Related Chronic Kidney Disease. Can J Gastroenterol Hepatol [Internet]. 2020 [cited 2023 Oct 6];2020. Available from: /pmc/articles/PMC7785379/

32. **Musso G, Gambino R, Tabibian JH, Ekstedt M, Kechagias S, Hamaguchi M, *et al.*** Association of Non-alcoholic Fatty Liver Disease with Chronic Kidney Disease: A Systematic Review and Meta-analysis. PLoS Med [Internet]. 2014 [cited 2023 Oct 15];11(7). Available from: /pmc/articles/PMC4106719/

33. **Kunutsor SK, Laukkanen JA.** Gamma-glutamyltransferase and risk of chronic kidney disease: A prospective cohort study. Clin Chim Acta [Internet]. 2017 Oct 1 [cited 2023 Oct 6];473:39–44. Available from: https://pubmed.ncbi.nlm.nih.gov/28811239/

34. **Chalasani N, Younossi Z, Lavine JE, Charlton M, Cusi K, Rinella M, *et al.*** The diagnosis and management of nonalcoholic fatty liver disease: Practice guidance from the American Association for the Study of Liver Diseases. Hepatology [Internet]. 2018 Jan 1 [cited 2023 Oct 15];67(1):328–57. Available from: https://pubmed.ncbi.nlm.nih.gov/28714183/

35. **Targher G, Byrne CD.** Non-alcoholic fatty liver disease: an emerging driving force in chronic kidney disease. Nat Rev Nephrol [Internet]. 2017 May 1 [cited 2023 Oct 15];13(5):297–310. Available from: https://pubmed.ncbi.nlm.nih.gov/28218263/

36. **Francque SM, van der Graaff D, Kwanten WJ.** Non-alcoholic fatty liver disease and cardiovascular risk: Pathophysiological mechanisms and implications. J Hepatol [Internet]. 2016 Aug 1 [cited 2023 Oct 15];65(2):425–43. Available from: http://www.journal-of-hepatology.eu/article/S0168827816301076/fulltext

37. **De Boer IH, Rue TC, Cleary PA, Lachin JM, Molitch ME, Steffes MW, *et al.*** Long-term renal outcomes of patients with type 1 diabetes and microalbuminuria: an analysis of the DCCT/EDIC cohort. Arch Intern Med [Internet]. 2011 Mar 3 [cited 2023 Oct 15];171(5):412. Available from: /pmc/articles/PMC3085024/

38. **Marcuccilli M, Chonchol M.** NAFLD and Chronic Kidney Disease. Int J Mol Sci [Internet]. 2016 Apr 14 [cited 2023 Oct 15];17(4). Available from: /pmc/articles/PMC4849018/

39. **Tziomalos K, Athyros VG.** Diabetic Nephropathy: New Risk Factors and Improvements in Diagnosis. Rev Diabet Stud [Internet]. 2015 [cited 2023 Oct 15];12(1–2):110. Available from: /pmc/articles/PMC5397986/

40. **Kanbay M, Bulbul MC, Copur S, Afsar B, Sag AA, Siriopol D, *et al.*** Therapeutic implications of shared mechanisms in non-alcoholic fatty liver disease and chronic kidney disease. J Nephrol [Internet]. 2020 May 21 [cited 2023 Oct 15];34(3):649–59. Available from: https://europepmc.org/article/med/32440840

41. **Galiero R, Caturano A, Vetrano E, Cesaro A, Rinaldi L, Salvatore T, *et al.*** Pathophysiological mechanisms and clinical evidence of relationship between Nonalcoholic fatty liver disease (NAFLD) and cardiovascular disease. Rev Cardiovasc Med [Internet]. 2021 Sep 24 [cited 2023 Oct 15];22(3):755–68. Available from: https://pubmed.ncbi.nlm.nih.gov/34565074/

42. **Duan JY, Duan GC, Wang CJ, Liu DW, Qiao YJ, Pan SK, *et al.*** Prevalence and risk factors of chronic kidney disease and diabetic kidney disease in a central Chinese urban population: a cross-sectional survey. BMC Nephrol [Internet]. 2020 Apr 3 [cited 2023 Oct 15];21(1). Available from: /pmc/articles/PMC7118942/

43. **Kaewput W, Thongprayoon C, Rangsin R, Ruangkanchanasetr P, Bathini T, Mao MA, *et al.*** Association between serum uric acid and chronic kidney disease in patients with hypertension: A multicenter nationwide cross-sectional study. J Evid Based Med [Internet]. 2019 Nov 1 [cited 2023 Oct 15];12(4):235–42. Available from: https://onlinelibrary.wiley.com/doi/full/10.1111/jebm.12364

44. **Huang Q, Yu J, Zhang X, Liu S, Ge Y.** Association of the serum uric acid level with liver histology in biopsy-proven non-alcoholic fatty liver disease. Biomed Rep [Internet]. 2016 Aug 1 [cited 2023 Oct 15];5(2):188. Available from: /pmc/articles/PMC4950169/

45. **Vilar-Gomez E, Calzadilla-Bertot L, Friedman SL, Gra-Oramas B, Gonzalez-Fabian L, Villa-Jimenez O, *et al.*** Improvement in liver histology due to lifestyle modification is independently associated with improved kidney function in patients with non-alcoholic steatohepatitis. Aliment Pharmacol Ther [Internet]. 2017 Jan 1 [cited 2023 Oct 15];45(2):332–44. Available from: https://pubmed.ncbi.nlm.nih.gov/27862096/

46. **Asghar MS, Hassan M, Rasheed U, Kazmi SJH, Khan NA, Khalid F, *et al.*** Impact of Fasting Lipid Profile on Chronic Kidney Disease Patients Having Fatty Liver Disease. Cureus [Internet]. 2020 Oct 25 [cited 2023 Oct 15];12(10). Available from: /pmc/articles/PMC7685813/

47. **Bril F, Cusi K.** Nonalcoholic Fatty Liver Disease: The New Complication of Type 2 Diabetes Mellitus. Endocrinol Metab Clin North Am [Internet]. 2016 Dec 1 [cited 2023 Oct 15];45(4):765–81. Available from: https://pubmed.ncbi.nlm.nih.gov/27823604/

العلاقة بين مرض الكبد الدهني غير الكحولي ومرض الكلى المزمن لدى المرضى المصريين

سونيا أحمد علي الجعلي[١]، عصام محمد بيومي[١]، مارينا موريس بيباوي[٢] و أحمد مجدي فتح الله منصور[١]

[١]وحدة أمراض الجهاز الهضمي و الكبد، قسم الباطنة العامة، كلية الطب، جامعة عين شمس، القاهرة، مصر

[٢]المعهد القومي للكلى و المسالك البولية، القاهرة، مصر

المقدمة: يعتبر مرض الكبد الدهني غير الكحولي (NAFLD) مرضًا عالميًا عامًا يؤثر في ملايين الأشخاص في جميع أنحاء العالم. وعلى النقيض من ذلك، لا يزال مفهوم مرض الكلى المزمن (CKD) يتطور من كونه نتيجة شائعة لأمراض مختلفة إلى مجموعة من المضاعفات الخطيرة التي تؤثر على أعضاء متعددة في الجسم. تظهر حاليًا موجة من الفرضيات والدراسات التي تشير إلى وجود صلة محتملة بين مرض الكبد الدهني غير الكحولي ومرض الكلى المزمن كمجال مثير للاهتمام في مجال البحث. يعتبر كل من مرض الكلى المزمن ومرض الكبد الدهني غير الكحولي (NAFLD) من الاضطرابات الخطيرة التي تؤدي إلى العديد من المضاعفات وتؤدي إلى أعباء اقتصادية كبيرة في جميع أنحاء العالم.

الهدف من الدراسة: هدفت هذه الدراسة إلى تقييم العلاقة بين مرض الكلى المزمن ومرض الكبد الدهني غير الكحولي في المرضى المصريين.

نتائج الدراسة: أفادت دراستنا بوجود فرق إحصائي كبير للغاية بين مجموعة مرضى الكبد الدهني غير الكحولي والمجموعة غير المصابة بمرض الكبد الدهني غير الكحولي فيما يتعلق بمراحل مرض الكلى المزمن، على الرغم من وجود فرق غير كبير بين مجموعات الدراسة فيما يتعلق بمعدل الترشيح الكبيبي المقدر (eGFR). كما ظهر فرق كبير إحصائيًا بين المجموعتين فيما يتعلق بالسمنة وارتفاع ضغط الدم، بالإضافة إلى فرق كبير جدًا فيما يتعلق بمتلازمة التمثيل الغذائي (MetS). في المقابل، كان هناك فرق غير كبير إحصائيًا بين المجموعتين فيما يتعلق بتطور مرض السكري (DM).

الاستنتاج: يرتبط مرض الكبد الدهني غير الكحولي، جنبًا إلى جنب مع الحالات المرضية المصاحبة المختلفة، بإمكانية تطور مرض الكلى المزمن. نوصي بالتقييم الدقيق لمرضى الكبد الدهني غير الكحولي، وخاصة أولئك الذين يعانون من أمراض مصاحبة، لتطور مرض الكلى المزمن. يجب أن تركز الدراسات المستقبلية على عوامل الخطر المحتملة والآليات السببية والأهداف العلاجية المحتملة لكل من مرض الكبد الدهني غير الكحولي ومرض الكلى المزمن في حالة مرضية مصاحبة.