DOI: https://doi.org/10.30841/2786-720X.3.2025.339921
UDC 616.36-002.2:616.1-085

Effect of liraglutide and dapagliflozin on cardiovascular risk in metabolic dysfunction-associated steatotic liver disease patients

V. V. Cherniavskyi, A. I. Akimov, L. O. Onyshchuk, V. V. Tishchenko
Bogomolets National Medical University, Kyiv

The objective: **to assess and compare lipid profiles in patients with metabolic dysfunction-associated steatotic liver disease (MASLD) before and after treatment with liraglutide or dapagliflozin, as well as to evaluate cardiovascular risk using five stratified scales and analyze intergroup differences.**
Materials and methods**. This prospective, randomized, parallel-group study included 115 patients of both sexes, aged 26–67 years, with MASLD. Participants were divided into three groups: a control group (CG) (36 patients), Group IA (41 patients), and Group IB (38 patients). The CG was advised to follow the Mediterranean diet and engage in moderate-intensity physical activity for 150 minutes per week. Group IA followed the same non-pharmacological recommendations, with the addition of dapagliflozin 10 mg once daily. Group IB also adhered to the same non-pharmacological regimen, along with liraglutide, starting at a dose of 0.6 mg once daily, gradually increasing to 1.8 mg weekly. All groups followed the assigned recommendations for three months.**
At the baseline visit, lipid profile indicators, blood pressure, and cardiovascular risk was assessed using five stratified risk scales: the Globorisk tool, Framingham Risk Score (10-year cardiovascular diseases (CVD) risk estimation), American College of Cardiology (ACC) / American Heart Association (AHA) ASCVD Risk Calculator (10-year risk of heart disease or stroke; algorithm published in 2013), Prospective Cardiovascular Münster (PROCAM) Score, and the World Health Organization (WHO) CVD risk chart. After three months, these indicators were reassessed, and cardiovascular risk was recalculated.
Results**. Significant improvements in lipid profile indicators were observed in all groups after treatment. Total cholesterol, low-density lipoprotein (LDL), and triglycerides decreased significantly, while high-density lipoprotein (HDL) levels increased ($p < 0.001$ for all). HDL levels showed a more pronounced increase in Group IB compared to the CG ($p = 0.02$). Cardiovascular risk decreased significantly in all groups ($p < 0.05$), with consistent reductions observed across all five scales. No statistically significant intergroup differences in cardiovascular risk reduction were found ($p > 0.05$).**
Conclusions**. Both liraglutide and dapagliflozin significantly improved lipid profiles and reduced cardiovascular risk in patients with MASLD. Total cholesterol, LDL, and triglycerides decreased significantly in all groups, while HDL levels increased, with a more pronounced effect in the liraglutide group. No significant intergroup differences were observed in total cholesterol, LDL, triglycerides, or cardiovascular risk reductions, suggesting similar efficacy of both treatments in these aspects. However, the greater increase in HDL levels in the liraglutide group highlights its potential advantage in modifying lipid metabolism.**
Keywords: *metabolic dysfunction-associated steatotic liver disease, dyslipidemia, steatohepatitis, cardiovascular risk, glucose-lowering medications, liraglutide, dapagliflozin.*

Вплив ліраглутиду та дапагліфлозину на серцево-судинний ризик у пацієнтів зі стеатотичною хворобою печінки, асоційованою з метаболічною дисфункцією

В. В. Чернявський, А. І. Акімов, Л. О. Онищук, В. В. Тіщенко

Мета дослідження: оцінка та порівняння ліпідного профілю в пацієнтів із метаболічно асоційованою стеатотичною хворобою печінки (МАСХП) до та після лікування ліраглутидом або дапагліфлозином, а також визначення серцево-судинного ризику за п'ятьма стратифікованими шкалами та аналіз міжгрупових відмінностей.
Матеріали та методи**.** Проспективне, рандомізоване, паралельне дослідження включало 115 пацієнтів обох статей віком від 26 до 67 років із діагностованою МАСХП. Учасники були розподілені на 3 групи: контрольну групу (КГ) – 36 пацієнтів, групу ІА – 41 пацієнт, групу ІВ – 38 пацієнтів. КГ отримувала рекомендації щодо дотримання середземноморської дієти та регулярної фізичної активності помірної інтенсивності (150 хв/тиж.). Група ІА отримувала ті самі немедикаментозні рекомендації з додатковим прийомом дапагліфлозину в дозі 10 мг 1 р/добу. Група ІВ також дотримувалася немедикаментозних рекомендацій і додатково приймала ліраглутид, починаючи з дози 0,6 мг 1 р/добу з щотижневим підвищенням до 1,8 мг. Усі пацієнти дотримувалися призначених рекомендацій протягом 3 місяців.
На первинному візиті пацієнтів оцінювали показники ліпідограми, артеріального тиску та розраховували серцево-судинний ризик за п'ятьма стратифікованими шкалами: Globorisk tool, Framingham Risk Score (10-річна оцінка ризику), American College of Cardiology (ACC) / American Heart Association (AHA) ASCVD Risk Calculator (10-річна оцінка ризику серцево-судинних захворювань або інсульту; алгоритм 2013 р.), Prospective Cardiovascular Münster (PROCAM) Score та World Health Organization (WHO) CVD risk chart. Через 3 місяці ці ж показники були повторно оцінені та прораховано серцево-судинний ризик.
Результати**.** Статистично значуще покращення показників ліпідограми спостерігалося в усіх групах після лікування.

Рівні загального холестерину, ліпопротеїнів низької щільності (ЛПНЩ) та тригліцеридів значно знизилися, а рівень ліпопротеїнів високої щільності (ЛПВЩ) підвищився ($p < 0,001$ для всіх показників). У групі ІВ підвищення рівня ЛПВЩ було більш вираженим порівняно з КГ ($p = 0.02$). Серцево-судинний ризик значно знизився в усіх групах ($p < 0.05$), причому спостерігалися стійкі зниження за всіма п'ятьма шкалами. Статистично значущих міжгрупових відмінностей щодо зниження серцево-судинного ризику не виявлено ($p > 0.05$).

Висновки. І ліраглутид, і дапагліфлозин значно покращували ліпідний профіль та знижували серцево-судинний ризик у пацієнтів із МАСХП. У всіх групах відзначено зниження рівнів загального холестерину, ЛПНЩ, а також підвищення рівня ЛПВЩ, причому останнє було більш вираженим у групі, що отримувала ліраглутид. Значущих міжгрупових відмінностей у зниженні загального холестерину, ЛПНЩ, тригліцеридів і загального серцево-судинного ризику не виявлено, що свідчить про подібну ефективність обох методів лікування. Водночас більш значне підвищення рівня ЛПВЩ у групі ліраглутиду вказує на його потенційну перевагу в корекції ліпідного метаболізму.

Ключові слова: *стеатотична хвороба печінки, асоційована з метаболічною дисфункцією, дисліпідемія, стеатогепатит, серцево-судинний ризик, цукрознижувальні препарати, ліраглутид, дапагліфлозин.*

Metabolic dysfunction-associated steatotic liver disease (MASLD) is one of the most common chronic liver diseases in the world. The global prevalence of MASLD has increased from 25% in 2016 to over 30% today, and its incidence continues to rise [1, 2].

The main risk factors for MASLD are abdominal obesity, insulin resistance, type 2 diabetes mellitus, arterial hypertension, and dyslipidemia [3, 4]. MASLD increases the risk of developing fibrosis, cirrhosis, and hepatocellular carcinoma [1, 5]. Extrahepatic risks include an increased likelihood of cardiovascular diseases (CVD), chronic kidney disease, and certain types of cancer, such as thyroid cancer and gastrointestinal tumors [6–8].

MASLD has been recognized as an independent risk factor for CVD based on numerous studies demonstrating its association with an increased risk of cardiovascular events [9]. Patients with MASLD have a significantly higher incidence of CVD than the general population, and cardiovascular conditions are the leading cause of mortality in these patients [10]. This is due to the presence of shared risk factors described above, which increase the likelihood of developing atherosclerosis and cardiovascular complications [11]. Additionally, systematic reviews and meta-analyses confirm that even mild steatosis is associated with an increased cardiovascular risk [12, 13].

The primary treatment method remains lifestyle modification, specifically adherence to a Mediterranean diet and moderate physical activity (more than 150 minutes per week). This approach has shown improvements in liver damage markers and a reduction in liver steatosis [14, 15].

However, the efficacy of non-pharmacological approaches is not sufficient in cases of more severe liver steatosis. Possible pharmacological treatment options include vitamin E, pioglitazone, sodium-glucose cotransporter 2 (SGLT2) inhibitors, glucagon-like peptide-1 (GLP-1) receptor agonists, and thyroid hormone receptor β1 agonist (resmetirom). All of these require further study to provide clearer recommendations [16, 17].

Liraglutide, a representative of GLP-1 receptor agonists, has shown effectiveness in reducing body weight, liver steatosis, improving glycemic profiles, and lowering alanine aminotransferase (ALT) and aspartate aminotransferase (AST) levels in patients with MASLD [18].

Dapagliflozin, a representative of SGLT2 inhibitors, like liraglutide, has a positive effect on reducing blood glucose levels and decreasing liver inflammation. It is also suggested that this drug can reduce liver fat infiltration by inhibiting lipid and bile acid synthesis through suppression of LXRα-mediated (Liver X Receptor alpha) pathways [19].

The unresolved question remains the comparative effectiveness of liraglutide and dapagliflozin in patients with MASLD, particularly in reducing cardiovascular risk, which is the leading cause of mortality in these patients.

The objective: to assess and compare lipid profiles in patients with MASLD before and after treatment with liraglutide and dapagliflozin, as well as to evaluate cardiovascular risk using five stratified scales, and to analyze intergroup differences.

MATERIALS AND METHODS

This study is a part of a dissertation project and was conducted at the clinical base of the Department of Internal Medicine № 1, Bogomolets National Medical University, Kyiv, Ukraine. The research protocol was approved by the Commission on Bioethical Expertise and Ethics of Scientific Research at Bogomolets National Medical University (Approval № 187, dated 23.09.2024).

The authors adhered to the principles of the Helsinki Declaration, the Council of Europe Convention on Human Rights and Biomedicine (1997), relevant provisions of WHO, the International Council of Medical Scientific Societies, the International Code of Medical Ethics (1983), and the laws of Ukraine. All patients provided informed consent to participate in the study.

Patients. The study sample consisted of patients of both sexes aged 26–67 years with MASLD. The diagnosis of MASLD was made before the study based on the presence of liver steatosis, detected by steatometry, and the presence of at least one of five cardiometabolic criteria according to the 2023 recommendations [20].

Exclusion criteria included: a history of cardiovascular events, liver cirrhosis, alcoholic liver disease, viral hepatitis, oncological and hematological diseases, pregnancy, and lactation.

Study design. The study is an open, prospective, randomized, study in parallel groups. It includes two stages: at the first stage, 115 patients with MASLD were included and divided into two groups – 36 patients with MASLD were assigned to the control group (CG), which followed standardized treatment: a Mediterranean diet and 150 minutes per week of the moderate-intensity physical activity, and 79 patients with MASLD, who were assigned to the study group, following standardized non-pharmacological therapy and receiving a pharmaceutic drug.

At the second stage, the study group was divided into two subgroups: Group IA and Group IB. Group IA consisted of 38 patients who received liraglutide at an initial dose of 0.6 mg once daily, with weekly increases to 1.8 mg over 3 months. Group IB consisted of 41 patients who received dapagliflozin at a dose of 10 mg once daily for 3 months.

Patients were randomized using a computer-generated randomization sequence. Randomization was stratified by age to ensure the balanced distribution of this demographic factor across the control and study groups.

Visits. During the initial visit, all patients underwent a physical examination, complaints and anamnesis were collected, instrumental investigation was conducted – liver steatometry to confirm liver steatosis using the Soneus P7 UltraSign (Ukraine), and lipid profile laboratory tests were completed.

After 3 months of prescribed treatment, the above laboratory and instrumental assessments were repeated.

Cardiovascular risk assessment. During the first visit and after 3 months, cardiovascular risk was assessed using five validated risk scales: Globorisk tool, Framingham Risk Score (10-year CVD risk estimation), American College of Cardiology (ACC) / American Heart Association (AHA) ASCVD Risk Calculator (10-year risk of heart disease or stroke; algorithm published in 2013), Prospective Cardiovascular Münster (PROCAM) Score, and World Health Organization (WHO) CVD risk chart [21–25].

These scales were selected as they either incorporate type 2 diabetes mellitus as a key parameter or include various lipid profile indicators. Considering that MASLD is closely associated with metabolic dysfunctions such as dyslipidemia and insulin resistance, these tools provided a comprehensive assessment of cardiovascular risk factors, specific to the study population.

Although the SCORE2 / SCORE2-OP scale (Systematic COronary Risk Evaluation; Older Persons) is validated for use in Ukraine, it does not account for the presence of type 2 diabetes mellitus, a significant cardiovascular risk factor prevalent in the majority of our study patients. Moreover, the SCORE2 scale is designed to estimate the 10-year risk of both fatal and non-fatal cardiovascular events in the general population aged under 70 years without established CVD, which may not fully capture the comprehensive cardiovascular risk profile of patients with metabolic dysfunctions like MASLD.

Statistical analysis. The statistical analysis of the study results was conducted using IBM SPSS v.29 software. The Shapiro–Wilk test was used to check for normal distribution. In the case of normal distribution, the data were presented as arithmetic mean and standard deviation (Mean ± SD), and in the case of non-normal distribution, as median with first and third quartiles (Median [Q1; Q3]). To assess the difference between the means of the two groups, the independent (unpaired) t-test (in the case of normal distribution) or the Wilcoxon 2-sample test (in the case of non-normal distribution) was used. One-way analysis of variance (ANOVA) was employed to determine differences between the three groups (for normal distribution), or the Kruskal–Wallis test (for data with a non-normal distribution). Post-hoc analysis was performed using the Bonferroni correction for a posteriori pairwise comparisons. For categorical variables, the chi-squared test (χ^2) was used to assess differences in proportions or frequencies between groups. The difference between the study groups was considered statistically significant at $p < 0.05$.

RESULTS AND DISCUSSION

Baseline characteristics of the study participants, including demographic, clinical, and biochemical parameters, are summarized in Table 1. Patients were divided into three groups: the CG (n = 36), Group IA (dapagliflozin, n = 41), and Group IB (liraglutide, n = 38). These characteristics demonstrate the homogeneity of the groups at baseline, ensuring the comparability of treatment outcomes.

Lipid profile changes. Significant improvements in lipid profile indicators were observed after 3 months of treatment in all groups. Total cholesterol, low-density lipoprotein (LDL), and triglycerides significantly decreased, while high-density lipoprotein (HDL) levels increased ($p < 0.001$ for all). These changes highlight the effectiveness of both liraglutide and dapagliflozin in improving lipid metabolism in MASLD patients. Detailed results are presented in Table 2.

Cardiovascular risk changes. Cardiovascular risk, assessed using five validated scales, decreased significantly in all groups after treatment. Reductions were observed consistently across the Globorisk tool, Framingham Risk Score, ACC / AHA ASCVD Risk Calculator, PROCAM, and WHO CVD Risk Chart ($p < 0.05$ for all). These findings emphasize the potential of liraglutide and dapagliflozin in effectively managing cardiovascular risk. Summarized results are provided in Table 2.

Intergroup comparisons. The intergroup analysis highlighted several important findings. While no significant differences were noted in the reduction of total cholesterol, LDL, or triglycerides between the groups ($p > 0.05$), HDL levels increased significantly more in Group IB compared to the CG ($p = 0.02$).

Despite overall reductions of cardiovascular risk, intergroup comparisons revealed no statistically significant differences in cardiovascular risk scores between the groups ($p > 0.05$). Detailed comparisons between the groups are presented in Table 3.

Adverse effects. No significant adverse events were reported during the 3-month treatment period. Mild and temporary side effects were observed in a small number of patients. Gastrointestinal symptoms (nausea and diarrhea) were noted in 7 patients (18.4%) receiving liraglutide, while urinary tract infections occurred in 10 patients (24.4%) treated with dapagliflozin. These effects were transient and did not lead to treatment discontinuation.

In this prospective study, patients with MASLD were evaluated, and their lipid profile indicators and cardiovascular risk were assessed using five stratified scales (Globorisk tool, Framingham Risk Score (10-year CVD risk estimation), American College of Cardiology (ACC) / American Heart Association (AHA) ASCVD Risk Calculator (10-year risk of heart disease or stroke; algorithm published in 2013), Prospective Cardiovascular Münster (PROCAM) Score, and World Health Organization (WHO) CVD risk chart) [21–25]. The effectiveness of different treatment approaches over a 3-month period was examined.

FAMILY MEDICINE. EUROPEAN PRACTICES / СІМЕЙНА МЕДИЦИНА. ЄВРОПЕЙСЬКІ ПРАКТИКИ •
ISSN 2786-7218 (Online) | ISSN 2786-720X (Print)
№3 (113)/2025

Table 1

Baseline characteristics of study participants (X ± SD or Me [Q1; Q3])

Indicators		CG (n = 36)	Group IA (n = 41)	Group IB (n = 38)	Significance of difference, p
Age, years		43.3 ± 11.0	41.7 ± 10.7	39.6 ± 11.2	0.368
Age distribution, n (%)	25–34	8 (22.2)	12 (29.3)	10 (26.3)	0.972
	35–44	11 (30.6)	13 (31.7)	13 (34.2)	
	45–54	12 (33.3)	10 (24.4)	9 (23.7)	
	55–67	5 (13.9)	6 (14.6)	6 (15.8)	
Sex, n (%)	Men	25 (69)	24 (59)	30 (79)	0.147
	Women	11 (31)	17 (41)	8 (21)	
Severity of steatosis distribution, n (%)	S1	9 (25)	14 (34.2)	8 (21.1)	0.526
	S2	14 (38.9)	12 (29.3)	18 (47.4)	
	S3	13 (36.1)	15 (36.5)	12 (31.5)	
Smoking (yes, %)		12 (33.3)	9 (21.9)	11 (28.9)	0.529
Medication use (yes, %)*		5 (13.6)	6 (14.6)	4 (10.5)	0.849
Diabetes mellitus (yes, %)		23 (63.9)	28 (68.3)	23 (60.5)	0.77
Arterial hypertension (yes, %)		7 (19.4)	9 (21.9)	7 (18.4)	0.921
Other comorbidities (yes, %)**		5 (13.8)	8 (19.5)	3 (7.9)	0.329
Systolic BP (mmHg)		132.5 ± 13.6	133.7 ± 16.6	132.2 ± 15.6	0.896
BMI (kg/m^2)		30.95 ± 3.40	31.61 ± 3.10	32.16 ± 4.40	0.371
Total cholesterol (mmol/L)		5.37 ± 1.00	5.3 ± 1.2	5.2 ± 1.3	0.844
LDL-C (mmol/L)		3.3 ± 0.7	3.1 ± 0.8	3.1 ± 0.9	0.639
HDL-C (mmol/L)		1.14 [1.05; 1.3]	1.18 [1.00; 1.34]	1.13 [1.01; 1.24]	0.699
Triglycerides (mmol/L)		2.1 [1.89; 2.47]	2.3 [2.01; 2.75]	2.4 [2.01; 2.92]	0.110
Globorisk (10-year risk, %)		25.1 [16.2; 33.9]	29.7 [19.9; 43.1]	20.2 [11.6; 29.1]	0.167
Framingham (10-year risk, %)		12.4 [6.8; 19.9]	15.2 [6.1; 23.5]	12.8 [8.9; 25.9]	0.793
ACC / AHA ASCVD (10-year risk, %)		8.2 [3.8; 11.7]	10.4 [6.2; 18.9]	5.1 [3.4; 11.2]	0.317
PROCAM (10-year risk, points)		38.1 ± 10.1	41.2 ± 11.2	38.7 ± 11.9	0.440
WHO CVD (10-year risk, %)		16 [11; 17]	17 [12; 27]	15 [9; 27]	0.322

Notes: * – medication use includes levothyroxine, sertraline or antihypertensive therapy (perindopril, enalapril + hydrochlorothiazide or valsartan); ** – other comorbidities include autoimmune thyroiditis, hypothyroidism, depressive disorder; BMI – body mass index; LDL-C – low-density lipoprotein cholesterol; HDL-C – high-density lipoprotein cholesterol.

Table 2

Comparative characteristics of lipid profile indicators and cardiovascular risk, assessed by 5 scales, in patients with MASLD before and after 3 months of treatment (X ± SD or Me [Q1; Q3])

Indicators	Before treatment (n = 115)	After treatment (n = 115)	Significance of difference, p
Total cholesterol (mmol/L)	5.30 ± 1.15	4.83 ± 1.00	< 0.001
LDL (mmol/L)	3.14 ± 0.80	2.78 ± 0.74	< 0.001
HDL (mmol/L)	1.15 ± 0.22	1.28 ± 0.21	< 0.001
Triglycerides (mmol/L)	2.23 [1.99; 2.77]	1.98 [1.74; 2.52]	< 0.001
Globorisk (10-year risk, %)	22.9 [14.8; 36.5]	20.7 [12.9; 31.8]	< 0.001
Framingham (10-year risk, %)	13.4 [6.7; 21.6]	10.6 [5.8; 18.3]	< 0.001
ACC / AHA ASCVD (10-year risk, %)	8.6 [4; 15]	6.9 [2.7; 11.3]	< 0.001
PROCAM (10-year risk, points)	39.5 ± 11.1	34.8 ± 10.8	< 0.001
WHO CVD (10-year risk, %)	16 [10; 22]	15 [10; 21]	0.022

Table 3

Comparative characteristics of lipid profile indicators and cardiovascular risk, assessed by 5 scales, in patients with MASLD after 3 months, depending on the type of treatment (X ± SD or Me [Q1; Q3])

Indicators	CG (n = 36)	Group IA (n = 41)	Group IB (n = 38)	Significance of difference, p
Total cholesterol (mmol/L)	5.0 ± 0.8	4.87 ± 0.98	4.60 ± 1.13	0.27
LDL (mmol/L)	2.97 ± 0.66	2.73 ± 0.74	2.67 ± 0.79	0.19
HDL (mmol/L)	1.20 ± 0.21	1.27 ± 0.21	1.35 ± 0.20	$p_1 = 0.59$ $p_2 = 0.02$ $p_3 = 0.35$
Triglycerides (mmol/L)	2.1 [1.89; 2.47]	1.99 [1.66; 2.4]	1.91 [1.53; 2.44]	0.24
Globorisk (10-year risk, %)	22.7 [13.1; 31.8]	21.2 [15.5; 36]	15.6 [10.1; 23.6]	0.31
Framingham (10-year risk, %)	10.1 [5.8; 17.9]	9.9 [3.3; 16.9]	9.7 [6.4; 17.8]	0.68
ACC / AHA ASCVD (10-year risk, %)	7.5 [3.7; 10.4]	6.4 [3.7; 11.6]	3.2 [2.2; 8.7]	0.28
PROCAM (10-year risk, points)	36.1 ± 10.4	34.90 ± 9.55	32.20 ± 11.56	0.39
WHO CVD (10-year risk, %)	16 [11; 21]	15 [13; 24]	14 [8; 16]	0.22

Notes: p_1 – statistical significance of the difference between the CG and Group IA; p_2 – statistical significance of the difference between the CG and Group IB; p_3 – statistical significance of the difference between Group IA and Group IB.

The treatment approaches varied: standardized treatment, the addition of dapagliflozin, or liraglutide. The study demonstrated the effectiveness of any of these approaches, showing improvements in lipid profile values in improving lipid profile indicators, including reductions in total cholesterol, LDL, and triglycerides, alongside with increase in HDL level. Liraglutide, a GLP-1 receptor agonist, demonstrated its beneficial effects through weight reduction and improved insulin sensitivity, which are known to impact lipid metabolism [26]. Dapagliflozin, an SGLT2 inhibitor, reduces hepatic fat infiltration, potentially improving lipid profiles and glycemic control [27].

Notably, HDL levels increased significantly more in Group IB (liraglutide) compared to the CG. This result highlights the potential of liraglutide to have a more pronounced effect on HDL level, possibly due to its role in enhancing reverse cholesterol transport [28]. However, further studies are needed to explore the mechanisms underlying these changes.

Cardiovascular risk, assessed using five validated scales, decreased significantly in all groups, confirming the efficacy of these treatments in addressing both traditional and metabolic risk factors. Despite consistent reductions, no statistically significant intergroup differences were observed, suggesting similar efficacy of standardized treatment alone, liraglutide and dapagliflozin in reducing cardiovascular risk.

These results correlate with data presented in international scientific literature.

Although statistically significant differences were almost absent between the groups in the analyses of lipid profiles and cardiovascular risk scales, there was a trend toward improvement in these values, most notably in the liraglutide group, with moderate improvement in the dapagliflozin group. This trend may be attributed to the limited treatment duration of 3 months. Considering these positive results, further research with a longer duration of therapy is warranted to validate these findings.

CONCLUSIONS

This study demonstrated that both liraglutide and dapagliflozin significantly improve lipid profiles and reduce cardiovascular risk in patients with MASLD. Total cholesterol, LDL, and triglycerides decreased significantly in all groups, while HDL levels increased, with a more pronounced effect observed in the liraglutide group. Cardiovascular risk, assessed using five validated scales, consistently decreased across all groups, highlighting the potential of these treatments in managing both traditional and metabolic risk factors associated with MASLD.

No significant intergroup differences were observed in the reduction of total cholesterol, LDL, triglycerides, or cardiovascular risk scores, suggesting similar efficacy of liraglutide and dapagliflozin in these aspects. However, the greater increase in HDL levels in the liraglutide group underscores its potential advantage in modifying lipid metabolism.

Information about the authors

Cherniavskyi Volodymyr V. – Bogomolets National Medical University, Kyiv. *E-mail: vvch1979@gmail.com*
ORCID: 0000-0001-5831-8810
Akimov Artem I. – Bogomolets National Medical University, Kyiv; tel.: (096) 711-66-91. *E-mail: koganasyn@gmail.com*
ORCID: 0009-0005-3510-121X
Onyshchuk Liudmila O. – Bogomolets National Medical University, Kyiv. *E-mail: onishluda@gmail.com*
ORCID: 0009-0005-9737-0423
Tishchenko Viktoriya V. – Bogomolets National Medical University, Kyiv. *E-mail: vtishchenko1973@gmail.com*
ORCID: 0000-0002-7044-1974

Інформація про авторів

Чернявський Володимир Володимирович – Національний медичний університет імені О. О. Богомольця, м. Київ. *E-mail: vvch1979@gmail.com*

ORCID: 0000-0001-5831-8810

Акімов Артем Ігорович – Національний медичний університет імені О. О. Богомольця, м. Київ; тел.: (096) 711-66-91. *E-mail: koganasyn@gmail.com*

ORCID: 0009-0005-3510-121X

Онищук Людмила Олександрівна – Національний медичний університет імені О. О. Богомольця, м. Київ. *E-mail: onishluda@gmail.com*

ORCID: 0009-0005-9737-0423

Тіщенко Вікторія Вікторівна – Національний медичний університет імені О. О. Богомольця, м. Київ. *E-mail: vtishchenko1973@gmail.com*

ORCID: 0000-0002-7044-1974

REFERENCES

1. European Association for the Study of the Liver (EASL); European Association for the Study of Diabetes (EASD); European Association for the Study of Obesity (EASO); European Association for the Study of the Liver (EASL). EASL-EASD-EASO Clinical Practice Guidelines on the management of metabolic dysfunction-associated steatotic liver disease (MASLD). J Hepatol. 2024;81(3):492-542. doi: 10.1016/j.jhep.2024.04.031.
2. Younossi ZM, Koenig AB, Abdelatif D, Fazel Y, Henry L, Wymer M. Global epidemiology of nonalcoholic fatty liver disease-Meta-analytic assessment of prevalence, incidence, and outcomes. Hepatology. 2016;64(1):73-84. doi: 10.1002/hep.28431.
3. Karlsen TH, Sheron N, Zelber-Sagi S, Carrieri P, Dusheiko G, Bugianesi E, et al. The EASL-Lancet Liver Commission: protecting the next generation of Europeans against liver disease complications and premature mortality. Lancet. 2022;399(10319):61-116. doi: 10.1016/S0140-6736(21)01701-3.
4. Colantoni A, Bucci T, Cocomello N, Angelico F, Ettorre E, Pastori D, et al. Lipid-based insulin-resistance markers predict cardiovascular events in metabolic dysfunction associated steatotic liver disease. Cardiovasc Diabetol. 2024;23(1):175. doi: 10.1186/s12933-024-02263-6.
5. Phoolchund AGS, Khakoo SI. MASLD and the development of HCC: Pathogenesis and therapeutic challenges. Cancers (Basel). 2024;16(2):259. doi: 10.3390/cancers16020259.
6. Younossi Z, Anstee QM, Marietti M, Hardy T, Henry L, Eslam M, et al. Global burden of NAFLD and NASH: trends, predictions, risk factors and prevention. Nat Rev Gastroenterol Hepatol. 2018;15(1):11-20. doi: 10.1038/nrgastro.2017.109.
7. Oh J, Kim BK, Yoon J-H, Lee HH, Park H, Lee J, et al. Metabolic dysfunction-associated steatotic liver disease is associated with increased risk of kidney cancer: A nationwide study. Cancers. 2024;16(18):3161. doi: 10.3390/cancers16183161.
8. Targher G, Byrne CD, Tilg H. MASLD: A systemic metabolic disorder with cardiovascular and malignant complications. Gut. 2024;73(4):691-701. doi: 10.1136/gutjnl-2023-330595.
9. Platek AE, Szymanska A. Metabolic dysfunction-associated steatotic liver disease as a cardiovascular risk factor. Clin Exp Hepatol. 2023;9(3):187-92. doi: 10.5114/ceh.2023.130744.
10. 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. doi: 10.1016/j.jhep.2024.01.014.
11. Rinella ME, Lazarus JV, Ratziu V, Francque SM, Sanyal AJ, Kanwal F, et al. A multisociety Delphi consensus statement on new fatty liver disease nomenclature. Ann Hepatol. 2024;29(1):101133. doi: 10.1016/j.aohep.2023.101133.
12. Jamalinia M, Zare F, Noorizadeh K, Bagheri LK. Systematic review with meta-analysis: Steatosis severity and subclinical atherosclerosis in metabolic dysfunction-associated steatotic liver disease. Aliment Pharmacol Ther. 2024;59(4):445-58. doi: 10.1111/apt.17869.
13. Mellinger JL, Pencina KM, Massaro JM, Hoffmann U, Seshadri S, Fox CS, et al. Hepatic steatosis and cardiovascular disease outcomes: An analysis of the Framingham Heart Study. J Hepatol. 2015;63(2):470-6. doi: 10.1016/j.jhep.2015.02.045.
14. Khalatbari-Soltani S, Imamura F, Brage S, De Lucia RE, Griffin SJ, Wareham NJ, et al. The association between adherence to the Mediterranean diet and hepatic steatosis: cross-sectional analysis of two independent studies, the UK Fenland Study and the Swiss CoLaus Study. BMC Med. 2019;17(1):19. doi: 10.1186/s12916-019-1251-7.
15. Haigh L, Kirk C, El Gendy K, Gallacher J, Errington L, Mathers JC, et al. The effectiveness and acceptability of Mediterranean diet and calorie restriction in non-alcoholic fatty liver disease (NAFLD): A systematic review and meta-analysis. Clin Nutr. 2022;41(9):1913-31. doi: 10.1016/j.clnu.2022.06.037.
16. Harrison SA, Taub R, Neff GW, Lucas KJ, Labriola D, Moussa SE, et al. Resmetirom for nonalcoholic fatty liver disease: a randomized, double-blind, placebo-controlled phase 3 trial. Nat Med. 2023;29(11):2919-28. doi: 10.1038/s41591-023-02603-1.
17. Rinella ME, Neuschwander-Tetri BA, Siddiqui MS, Abdelmalek MF, Caldwell S, Barb D, et al. AASLD Practice Guidance on the clinical assessment and management of nonalcoholic fatty liver disease. Hepatology. 2023;77(5):1797-835. doi: 10.1097/HEP.0000000000000323.
18. Yanai H, Adachi H, Hakoshima M, Iida S, Katsuyama H. Metabolic-Dysfunction-Associated Steatotic Liver Disease-Its Pathophysiology, Association with Atherosclerosis and Cardiovascular Disease, and Treatments. Int J Mol Sci. 2023;24(20):15473. doi: 10.3390/ijms242015473.
19. Jin Z, Yin R, Yuan Y, Zheng C, Zhang P, Wang Y, et al. Dapagliflozin ameliorates hepatic steatosis via suppressing LXRα-mediated synthesis of lipids and bile acids. Biochem Pharmacol. 2024;223:116167. doi: 10.1016/j.bcp.2024.116167.
20. Kanwal F, Neuschwander-Tetri BA, Loomba R, Rinella ME. Metabolic dysfunction-associated steatotic liver disease: Update and impact of new nomenclature on the American Association for the Study of Liver Diseases practice guidance on nonalcoholic fatty liver disease. Hepatology. 2024;79(5):1212-19. doi: 10.1097/HEP.0000000000000670.
21. Hajifathalian K, Ueda P, Lu Y, Woodward M, Ahmadvand A, Aguilar-Salinas CA, et al. A novel risk score to predict cardiovascular disease risk in national populations (Globorisk): a pooled analysis of prospective cohorts and health examination surveys. Lancet Diabetes Endocrinol. 2015;3(5):339-55. doi: 10.1016/S2213-8587(15)00081-9.
22. D'Agostino RB Sr, Vasan RS, Pencina MJ, Wolf PA, Cobain M, Massaro JM, et al. General cardiovascular risk profile for use in primary care: The Framingham Heart Study. Circulation. 2008;117(6):743-53. doi: 10.1161/CIRCULATIONAHA.107.699579.
23. Goff DC Jr, Lloyd-Jones DM, Bennett G, Coady S, D'Agostino RB, Gibbons R, et al. 2013 ACC/AHA guideline on the assessment of cardiovascular risk: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines. Circulation. 2014;129(25):49-73. doi: 10.1161/01.cir.0000437741.48606.98.
24. Assmann G, Cullen P, Schulte H. Simple scoring scheme for calculating the risk of acute coronary events based on the 10-year follow-up of the prospective cardiovascular Münster (PROCAM) study. Circulation. 2002;105(3):310-5. doi: 10.1161/hc0302.102575.
25. WHO CVD Risk Chart Working Group. World Health Organization cardiovascular disease risk charts: revised models to estimate risk in 21 global regions. Lancet Glob Health. 2019;7(10):1332-45. doi: 10.1016/S2214-109X(19)30318-3.
26. Szekeres Z, Nagy A, Jahner K, Szabados E. Impact of Selected Glucagon-like Peptide-1 Receptor Agonists on Serum Lipids, Adipose Tissue, and Muscle Metabolism-A Narrative Review. Int J Mol Sci. 2024;25(15):8214. doi: 10.3390/ijms25158214.
27. Latva-Rasku A, Honka MJ, Kullberg J, Mononen N, Lehtimäki T, Saltevo J, et al. The SGLT2 Inhibitor Dapagliflozin Reduces Liver Fat but Does Not Affect Tissue Insulin Sensitivity: A Randomized, Double-Blind, Placebo-Controlled Study With 8-Week Treatment in Type 2 Diabetes Patients. Diabetes Care. 2019;42(5):931-7. doi: 10.2337/dc18-1569.
28. Petrovic A, Igrec D, Rozac K, Bojanic K, Kuna L, Kolaric TO, et al. The Role of GLP1-RAs in Direct Modulation of Lipid Metabolism in Hepatic Tissue as Determined Using In Vitro Models of NAFLD. Curr Issues Mol Biol. 2023;45(6):4544-56. doi: 10.3390/cimb45060288.

Стаття надійшла до редакції 17.12.2024. – Дата першого рішення 23.12.2024. – Стаття подана до друку 30.01.2025