

**Table S1.** Identified miRNAs involved in liver fibrosis.

MiRNAs	Target genes	Expression	Role	Biological functions	References
<b>miR-188-5p</b>	PTEN	Upregulated	Promotion of liver fibrosis	Promoting HSCs activation and proliferation by targeting PTEN/AKT.	Riaz et al., 2021 [112]
<b>miR-455-3p</b>	HSF1	Downregulated	Inhibition of liver fibrosis	To inhibit HSCs activation via suppressing HSF1 expression to repress TGF- $\beta$ 1 signaling.	Wei et al., 2019 [113]
<b>miR-503</b>	Smad7	Upregulated	Promotion of liver fibrosis	Targeting Smad7 to induce TGF- $\beta$ 1/Smad to activate HSCs	Xie et al., 2021 [114]
<b>miR-17-5p</b>	Smad7 WIF1	Upregulated	Promotion of liver fibrosis	To activate TGF- $\beta$ 1/Smad and Wnt/ $\beta$ -catenin pathway through suppressing Smad7 and WIF1 respectively	Yu et al., 2015 [115] Zhou et al., 2020 [116]
<b>miR-214-3p</b>	Sufu	Upregulated	Promotion of liver fibrosis	To induce hedgehog pathway activation to promote HSCs activation	Ma et al., 2018 [117]
<b>miR-212</b>	Smad7	Upregulated	Promotion of liver fibrosis	To promote HSCs activation through inhibiting Smad7 expression to initiate TGF- $\beta$ pathway	Zhu et al., 2018 [118]
<b>miR-96</b>	FOXO3 Smad7	Upregulated	Promotion of liver fibrosis	To promote HSCs activation via initiating TGF- $\beta$ 1 pathway and enhancing proliferation	Kumar et al., 2023 [119]
<b>miR-542-3p</b>	BMP7	Upregulated	Promotion of liver fibrosis	Promoting HSCs activation via inhibiting BMP7 expression to lessen antagonize of TGF- $\beta$	Ji et al., 2019 [120]
<b>miR-708</b>	TMEM88	Upregulated	Promotion of liver fibrosis	To induce Wnt/ $\beta$ -catenin signaling pathway activation through decreasing TMEM88 expression	Xu et al., 2020 [121]
<b>miR-122</b>	P4HA1 TGF- $\beta$ 1	Downregulated	Inhibition of liver fibrosis	Impeding HSCs activation through	Li et al., 2013 [122]

				reducing the collagen mature, and inhibiting the signaling of TGF- $\beta$ 1	Nozari et al., 2020 [123]
<b>miR-618</b>	Smad4	Downregulated	Inhibition of liver fibrosis	To block HSCs activation by targeting Smad4 to inhibit TGF- $\beta$ 1/Smad pathway. To inhibit	Sun et al., 2022 [124]
<b>miR-124-3p</b>	PI3K	Downregulated	Inhibition of liver fibrosis	PI3k/AKT/FOXO3 pathway to induce activated HSCs apoptosis To restrain HSCs	Li et al., 2021 [125]
<b>miR-25-3p</b>	ADAM17 FKBP14	Downregulated	Inhibition of liver fibrosis	activation through suppressing Notch signaling Suppressing	Genz et al., 2019 [126]
<b>miR-3595</b>	ACSL4	Downregulated	Inhibition of liver fibrosis	ACSL4 expression to promote HSCs apoptosis to alleviate fibrosis. To inhibit CCR2 on	Wu et al., 2018 [127]
<b>miR-19b-3p</b>	CCR2	Downregulated	Inhibition of liver fibrosis	HSCs expression to suppress monocytes infiltrate into liver to decrease liver inflammation. To suppress HSCs	Lan et al., 2018 [128]
<b>miR-137-3p</b>	PPIC	Downregulated	Inhibition of liver fibrosis	activation induced by TGF- $\beta$ 1 through directly decreasing PPIC expression. To induce apoptosis	Yang et al., 2021 [129]
<b>miR-130a-3p</b>	MAPK TGF $\beta$ R1 TGF $\beta$ R2	Downregulated	Inhibition of liver fibrosis	and reduce proliferation and activation of HSCs To inhibit the angiogenic role of	Liu et al., 2021 [130]
<b>miR-671-5p</b>	Angpt1 VWF	Downregulated	Inhibition of liver fibrosis	HSCs mediated by Angpt1 and VWF To inhibit HSCs activation through	Yang et al., 2022 [131]
<b>miR-194</b>	AKT2	Downregulated	Inhibition of liver fibrosis	repressing AKT pathway to further inhibit TGF- $\beta$ 1/Smad pathway activation To alleviate HSCs	Wu et al., 2019 [132]
<b>miR-345-5p</b>	HIF-1 $\alpha$	Downregulated	Inhibition of liver fibrosis	activation through decreasing HIF-1 $\alpha$	Wang et al., 2022 [133]

<b>miR-193a/b-3p</b>	TGF- $\beta$ 2 CAPRIN1	Downregulated	Inhibition of liver fibrosis	expression to suppress TGF- $\beta$ 1/Smad signaling To inhibit TGF- $\beta$ pathway activation and promote apoptosis to repress HSCs. activation To suppress HSCs activation through inhibiting wnt/ $\beta$ -catenin pathway or hedgehog pathway	Ju et al., 2019 [134]
<b>miR-378</b>	Wnt-10 Gli3	Downregulated	Inhibition of liver fibrosis	To repress HSCs activation by inhibiting Notch pathway via directly inhibit JAG1, a ligand of Notch	Zaafan et al., 2022 [105] Hyun et al., 2016 [135]
<b>miR-489-3p</b>	JAG1	Downregulated	Inhibition of liver fibrosis	To inhibit HSCs activation through suppressing EMT process and ERK1 pathway	Li et al., 2021 [136]
<b>miR-155</b>	TCF4 AGTR1	Downregulated	Inhibition of liver fibrosis	To suppress HSCs activation via inhibiting TGF- $\beta$ 1/Smad pathway by downregulating PMP22 expression	Dai et al., 2015 [137]
<b>miR-139-5p</b>	PMP22	Downregulated	Inhibition of liver fibrosis	To block HSCs activation via weakening ZEB1 expression to further repress wnt/ $\beta$ -catenin signaling.	He et al., 2021 [138]
<b>miR-708</b>	ZEB1	Downregulated	Inhibition of liver fibrosis	To inhibit HSCs activation via blocking Notch signaling pathway and promote HSCs apoptosis.	Yang et al., 2020 [139]
<b>miR-148</b>	Notch2	Downregulated	Inhibition of liver fibrosis	To inhibit HSCs activation through decreasing FSTL1 expression to hamper Smad2/3 phosphorylation to inhibit TGF- $\beta$ 1/Smad pathway.	Zhou et al., 2022 [140]
<b>miR-29</b>	FSTL1	Downregulated	Inhibition of liver fibrosis		Xu et al., 2020 [141]

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Abbreviations: PTEN: phosphatase and tensin homolog; PI3K: phosphatidylinositol-3-hydroxykinase; AKT: protein kinase B; HSF1: heat shock factor 1; TGF- $\beta$ 1: Transform growth factor-  $\beta$ 1; Smad: Small mother against decapentaplegic; WIF1: WNT inhibitory factor 1; Sufu: suppressor-of-fused homolog; FOXO3: Forkhead box protein O3; BMP7: Bone morphogenetic protein 7; TMEM88: Transmembrane protein 88; P4HA1: prolyl 4-hydroxylase subunit alpha-1; PINK1: PTEN-induced putative kinase 1; ADAM17: A Disintegrin and Metalloproteinase 17; FKBP14: FK506 binding protein 14; ACSL4: Long-chain-fatty-acid-CoA ligase 4; CCR2: C-C motif chemokine receptor 2; PPIC: Peptidylprolyl isomerase C; MAPK: mitogen-activated protein kinase; TGF $\beta$ R: Transform growth factor beta receptor; Angpt1: Angipointin-1; VWF: Von Willebrand factor; HIF-1 $\alpha$ : hypoxia-inducible factor-1 $\alpha$ ; CAPRIN1: cell-cycle-associated protein 1; Gli3: Glioblastoma 3; JAG1: Jagged canonical Notch ligand 1. TCF4: T cell factor 4; AGTR1: Angiotensin II receptor type 1; EMT: Epithelial-mesenchymal transition; PMP22: Peripheral Myelin Protein 22; ZEB: Zinc finger E-box binding homeobox; FSTL1: Follistatin like 1.

**Table S2.** Identified lncRNAs in liver fibrosis.

LncRNAs	Targets	Expression	Role	Biological functions	Reference
LncRNA SNHG7	miR-378a-3p	Upregulated	Promotion of liver fibrosis	Promoting HSCs activation through targeting miR-378a-3p to increase downstream target DVL2 expression, which could lead to wnt/ $\beta$ -catenin pathway initiation. To alleviate HSCs activation through	Yu et al., 2019 [142]
LncRNA GAS5	miR-23a	Downregulated	Inhibition of liver fibrosis	impairing the effect of miR-23a to enhance PTEN expression. To stimulate HSCs activation through	Dong et al., 2019 [29]
LncRNA HOTAIR	miR-148a-3p	Upregulated	Promotion of liver fibrosis	diminishing the function of miR-148a-3p to enhance S1PR1 expression. To activate HSCs via as a ceRNA for	Chen et al., 2023 [143]
LncRNA ATB	miR-200a/c	Upregulated	Promotion of liver fibrosis	miR-200a/c to further elevate $\beta$ -catenin and ZNF217 expression respectively. To initiate HSCs activation through	Fu et al., 2017 [144] Zhu et al., 2016 [145]
LncRNA ANXA2P2	miR-9	Upregulated	Promotion of liver fibrosis	suppressing miR-9 to increase Anxa2 to induce TGF- $\beta$ 1 signaling.	Liao et al., 2022 [146]
LncRNA CCAT2	miR-34a-5p	Upregulated	Promotion of liver fibrosis	To aggravate HSCs activation through sponging the miR-	Gao et al., 2022 [147]

<b>LncRNA Gpr137bps</b>	miR-200a-3p	Upregulated	Promotion of liver fibrosis	34a-5p to enhance Smad4 expression. To promote HSCs activation through sponging miR-200a-3p to intensify CXCL14 expression. To initiate HSCs activation via promoting Smad2/3 phosphorylation to bind with TGFβRI and increase MTF-1 expression, both of which can induce TGF-β1/Smad pathway activation. To suppress HSCs activation through inhibiting SMO expression or sponging miR-212 to enhance PTCH1 expression to further repress hedgehog pathway.	Liao et al., 2021 [148]
<b>LncRNA LFAR1</b>	Smad2/3 and MTF-1	Upregulated	Promotion of liver fibrosis	To promote HSCs activation through sponging miR-152 to elevate ATG14 expression to augment HSCs autophagy. To initiate HSCs activation via lessening the effect of miR-16a-5p to increase TGF-β2 expression. To induce HSCs activation via weakening miR-181a-5p to enhance TLR4/NF-κB signaling.	Zhang et al., 2017 [149] Xuan et al., 2020 [150]
<b>LncRNA MEG3</b>	SMO And miR-212	Downregulated	Inhibition of liver fibrosis	To promote HSCs activation through sponging miR-152 to elevate ATG14 expression to augment HSCs autophagy. To initiate HSCs activation via lessening the effect of miR-16a-5p to increase TGF-β2 expression. To induce HSCs activation via weakening miR-181a-5p to enhance TLR4/NF-κB signaling.	Yu et al., 2018 [151]
<b>LncRNA PVT1</b>	miR-152	Upregulated	Promotion of liver fibrosis	To initiate HSCs activation through sponging miR-152 to elevate ATG14 expression to augment HSCs autophagy. To initiate HSCs activation via lessening the effect of miR-16a-5p to increase TGF-β2 expression. To induce HSCs activation via weakening miR-181a-5p to enhance TLR4/NF-κB signaling.	Yu et al., 2020 [152]
<b>LncRNA MIAT1</b>	miR-16-5p	Upregulated	Promotion of liver fibrosis	To initiate HSCs activation through sponging miR-152 to elevate ATG14 expression to augment HSCs autophagy. To initiate HSCs activation via lessening the effect of miR-16a-5p to increase TGF-β2 expression. To induce HSCs activation via weakening miR-181a-5p to enhance TLR4/NF-κB signaling.	Ding et al., 2023 [153]
<b>LncRNA MALAT1</b>	miR-181a-5p	Upregulated	Promotion of liver fibrosis	To initiate HSCs activation through sponging miR-152 to elevate ATG14 expression to augment HSCs autophagy. To initiate HSCs activation via lessening the effect of miR-16a-5p to increase TGF-β2 expression. To induce HSCs activation via weakening miR-181a-5p to enhance TLR4/NF-κB signaling.	Wang et al., 2021 [154]
<b>LncRNA HELF</b>	PIK3R5	Upregulated	Promotion of liver fibrosis	To initiate HSCs activation through sponging miR-152 to elevate ATG14 expression to augment HSCs autophagy. To initiate HSCs activation via lessening the effect of miR-16a-5p to increase TGF-β2 expression. To induce HSCs activation via weakening miR-181a-5p to enhance TLR4/NF-κB signaling.	Han et al., 2023 [155]

<b>lncRNA ROR</b>	miR-145	Upregulated	Promotion of liver fibrosis	which can activate downstream AKT pathway. To aggravate HSCs activation via sponging miR-145 to increase ZEB2 expression that can activate HERC5 to further decrease p53 expression by promoting its IS-Gylation and degradation.	Shen et al., 2022 [156]
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Abbreviations: SNHG7: host gene 7; DVL2: dishevelled segment polarity protein 2; GAS5: growth arrest-specific transcript 5; HOTAIR: HOX transcript antisense intergenic RNA; S1PR1: Sphingosine 1-phosphate receptor 1; ATB: Activated by TGF- $\beta$ ; Anxa2: Annexins A2; CCAT2: Colon cancer associated transcript 2; Gpr137b-ps: G protein-coupled receptor 137B; CXCL14: C-X-C motif chemokine ligand 14; LFAR1: liver fibrosis-associated lncRNA1; MTF-1: Metallic transcription factor-1; MEG3: maternally expressed gene 3; SMO: Smoothened; PVT1: plasmacytoma variant translocation 1; MIAT: myocardial infarction associated transcript; ATG14: autophagy-related gene 14; MALAT1: Metastasis associated lung adenocarcinoma transcript 1; TLR4: Toll like receptor 4; NF- $\kappa$ B: nuclear factor - $\kappa$ B; HELF: High expressed in liver fibrosis; PIK3R5: phosphoinositide 3- kinase regulatory subunit 5; PTBP1: polypyrimidine tract-binding protein 1; ROR: regulator of reprogramming; ZEB2: Zinc finger E-box binding homeobox 2; HERC5: HECT and RLD domain containing E3 ubiquitin protein ligase 5.

**Table S3.** Identified circRNAs in liver fibrosis.

CircRNA	Targets	Expression	Role	Biological functions	Reference
<b>Circ DIDO1</b>	miR-141-3p	Downregulated	Inhibition of liver fibrosis	To inhibit HSCs activation through sponging miR-141-3p expression to increase the level of PTEN.	Ma et al., 2022 [109]
<b>Circ PSD3</b>	miR-92b-3p	Downregulated	Inhibition of liver fibrosis	To suppress HSCs activation via sponging miR-92b-3p to elevate Smad7 to repress TGF- $\beta$ /Smad pathway.	Bu et al., 2021 [157]
<b>Circ FBXW4</b>	miR-18b-3p	Downregulated	Inhibition of liver fibrosis	To mitigate HSCs activation via binding to miR-18b-3p to make FBXW7 overexpression, which could promote YAP-1 and Notch degradation.	Chen et al., 2020 [158]
<b>Circ CREBBP</b>	miR-1291	Downregulated	Inhibition of liver fibrosis	To attenuate HSCs activation through	Yang et al., 2020 [159]

				repressing miR-1291 effect to increase the expression of LEFTY2 that can inhibit Smad3 phosphorylation to suppress TGF- $\beta$ 1 signaling. To induce HSCs activation by sponging miR-203 and miR-223 to enhance FSTL1 and TLR4 expression respectively to induce TGF- $\beta$ 1 and NF- $\kappa$ B pathways. To promote HSCs activation through repressing the	
<b>Circ PWWP2A</b>	miR-203/miR-223	Upregulated	Promotion of liver fibrosis	function of miR-203a-3p to enhance its downstream target Smad3 expression.	Liu et al., 2019 [160]
<b>Circ TUBD1</b>	miR-203a-3p	Upregulated	Promotion of liver fibrosis	To induce HSCs activation via impeding miR-146a-5p expression to elevate the level of RAC1 which can mediate the HSCs transform to the fibrotic phenotype. To inhibit HSCs activation by directly binding to ATP5B to repress the ROS production.	Niu et al., 2022 [161]
<b>Circ RSF1</b>	miR-146a-5p	Upregulated	Promotion of liver fibrosis	To suppress HSCs activation through binding with miR-149-5p to delete its function of suppressing TGF- $\beta$ 2 expression.	Chen et al., 2020 [162]
<b>Circ SCAR</b>	ATP5B	Downregulated	Inhibition of liver fibrosis	To promote HSCs activation via repressing the antifibrotic function of miR-9-5p to restore the fibrotic targets.	Zhao et al., 2020 [163]
<b>Circ Ube2K</b>	miR-149-5p	Downregulated	Inhibition of liver fibrosis		Zhu et al., 2021 [164]
<b>Circ_0071410</b>	miR-9-5p	Upregulated	Promotion of liver fibrosis		Chen et al., 2017 [165]

<b>Circ ASPH</b>	miR-139-5p	Upregulated	Promotion of liver fibrosis	To initiate HSCs activation via suppressing miR-139-5p effect to increase Notch1 expression.	Meng et al., 2023 [166]
<b>Circ608</b>	miR-222	Downregulated	Inhibition of liver fibrosis	To repress HSCs activation through inhibiting miR-222 the effect to upregulate PINK1 expression which can mediate HSCs mitophagy to alleviate them activation.	Xu et al., 2022 [167]
<b>Circ_0000623</b>	miR-351-5p	Downregulated	Inhibition of liver fibrosis	To mitigate HSCs activation through restoring the autophagy flux by sponging the miR-351-5p function to enhance TFEB expression.	Du et al., 2023 [168]
<b>Circ_0070963</b>	miR-223-3p	Downregulated	Inhibition of liver fibrosis	To inhibit HSCs activation via sponging miR-223-3p to enhance LEMD3 expression that can antagonize TGF- $\beta$ 1Smad signaling.	Ji et al., 2020 [169]
<b>Circ cVIM</b>	miR-9-5p/miR-122-5p	Upregulated	Promotion of liver fibrosis	To attenuate HSCs activation by protecting TGF $\beta$ R1, TGF $\beta$ R2 and KLF6 against Downregulated by miR-9-5p and miR-122-5p.	Zhou et al., 2024 [170]

Abbreviations: DIDO1: Death-Inducer Obliterator 1; PSD3: Pleckstrin and Sec7 domain-containing 3; FBXW: F box and WD 40 domain containing protein; Yap1: Yes associated protein 1;; CREBP: CREB-binding protein; PWWP2A: PWWP domain containing 2A; TUBD1: Tubulin delta 1; RSF1: Remodeling spacing factor 1; RAC1: Ras-related c3 botulinum toxin substrate 1; ATP5B: ATP synthase F<sub>1</sub> subunit beta; SCAR: steatohepatitis-associated circRNA ATP5B regulato; ROS: reactive oxygen species; UBE2K: Ubiquitin-conjugating enzyme E2K; ASPH: Aspartate  $\beta$ -hydroxylase; TFEB: Transcription factor EB; LEMD3: LEM domain-containing protein 3; cVIM: circulation vimentin.