Supporting information

Novel 5-Oxo-hexahydroquinoline Derivatives: Design, Synthesis, *In vitro* P-glycoprotein Mediated Multidrug Resistance (MDR) Reversal Profile and Molecular Dynamics Simulation Study

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Synthesis:

3.1.1.1. 3-oxo-N-phenylbutanamide (**1a**).

Yield 82%; white powder; ^{1}H NMR (300MHz, DMSO-d_6) δ (ppm): 8.50 (s, 1H, amide N-H), 7.39 (d, 2H, *J* = 7.8 Hz, C_2, C_6 phenyl-H), 7.21 (t, 2H, *J* = 8.1 Hz, C_3, C_5 phenyl-H), 6.89 (t, 1H, *J* = 7.5 Hz, C_4 phenyl-H), 5.83 (s, 2H, CH_2), 2.51 (s, 3, CH_3). MS m/z (%):177 (43) [M^+], 160 (70), 93 (100), 85 (5), 77 (27).

3.1.1.1. N-(4-nitrophenyl)-3-oxobutanamide (**2a**)

Yield 55%; white powder; ^{1}H NMR (300MHz, DMSO-d_6) δ (ppm): IR (KBr) *v* (cm^{-1}): 3289.2 (N-H, amide), 3069.3 (C-H, aromatic), 2957.7, 2894.6 (C-H, aliphatic), 1712.1 (C=O, ketone), 1662.5 (C=O, amide); MS m/z (%):211.10 (23) [M+1], 155.10 (12), 128.00 (100), 101.00 (21), 43.00 (18).

3.1.1.2. 4-(3-oxobutanamido) benzoic acid (**4a**).

Yield 56%; white powder; ^{1}H NMR (300MHz, DMSO-d_6) δ (ppm): 12.71 (s, 1H, O-H), 10.38 (s, 1H, amide N-H), 7.89 (d, 2H, *J* = 8.7 Hz, C_2, C_6 phenyl-H), 7.21 (t, 2H, *J* = 8.7 Hz C_3, C_5 phenyl-H), 3.60 (s, 2H, CH_2), 2.22 (s, 3H, CH_3). MS m/z (%): 222.20 (87) [M], 206.20 (1), 138.10 (100), 108.00 (49).

3.1.1.3. N-(4-cyanophenyl)-3-oxobutanamide (**5a**)

Yield 78%; white powder; ^{1}H NMR (300MHz, DMSO-d_6) δ (ppm): 10.51 (s, 1H, amide N-H), 7.80-7.73 (m, 4H, phenyl-H), 3.62 (s, 2H, CH_2), 2.21 (s, 3H, CH_3). MS m/z (%): 183.10 (1), 149.10 (14), 85.00 (26), 43.00 (100).

3.1.2. General procedure for the synthesis of different 5-oxo-1,4,5,6,7,8-hexahydroquinoline-3-carboxamide derivatives

For the synthesis of each final compound, corresponding intermediate obtained from the previous step, different aldehydes and 1,3-cyclohexadione were dissolved in equimolar amounts, the mixture in the presence of excess amount of ammonium acetate (3 mmol) was refluxed overnight. The solvent was removed under vacuum. The deposit was washed using petroleum ether. Further purification was carried out by different chromatographic methods using chloroform/ethanol (95:5) as the eluent. The pure product was obtained by recrystallization from ethyl acetate (table 2).

3.1.2.1. 2-methyl-4-(3-nitrophenyl)-5-oxo-N-phenyl-1,4,5,6,7,8-hexahydroquinoline-3-carboxamide (**1d**)

Yield 46%; yellow powder; mp. 167℃; δ (ppm): δ ^{1}H NMR (300MHz, DMSO-d_6) δ: 9.66 (s, 1H, NH-amide), 8.98 (s, 1H, DHP-NH), 8.00-7.95 (m, 2H, $C_{2''}$, $C_{4''}$ nitrophenyl-H), 7.63 (d, 1H, *J* = 7.8 Hz, $C_{6''}$ nitrophenyl-H), 7.54-7.50 (m, 3H, $C_{5''}$ nitrophenyl-H, $C_{2'}$, $C_{6'}$ phenyl-H), 7.24 (t, 2H, *J*=7.5 Hz, $C_{3'}$, $C_{5'}$ phenyl-H), 7.00 (t, 1H, *J* = 7.5 Hz, $C_{4'}$ phenyl-H), 5.12 (s, 1H, DHP C_4-H), 2.23-2.19 (m, 2H, cyclohexanone C_8-H), 2.08 (s, 3H, DHP CH_3-H), 1.92-1.9 (2m, 2H, cyclohexanone C_7-H).^{13}C NMR (75 MHz, DMSO) δ: 194.66, 167.43, 153.41, 149.62, 148.11, 139.56, 135.97, 134.74, 129.94, 128.94, 123.62, 122.34, 121.36, 120.23, 110.33, 108.73, 38.56, 37.15, 26.78, 21.34, 17.49. IR (KBr) ν (cm^{-1}): 3264 (DHP N-H), 3068 (C-H, aromatic), 2948 (C-H, aliphatic), 1597 (C=O, amide, ketone), 1526, 1348 (C-NO_2

aromatic); MS m/z (%): 403.10 (16) [M], 386.20 (100), 356.10 (7), 311.10 (76), 281.10 (77), 188.00 (17), 162.10 (15), 93.00 (32). Anal. Calcd. C, 68.47; H, 5.25; N, 10.42; Found: C, 68.32; H, 5.14; N, 10.30 (%).

3.1.2.2. 2-methyl-4-(4-nitrophenyl)-5-oxo-N-phenyl-1,4,5,6,7,8-hexahydroquinoline-3-carboxamide (**1e**)

Yield 65%; orange powder; mp. 254℃; δ (ppm): δ ^{1}H NMR (300MHz, DMSO-d_6) δ: 8.09 (d, 2H, *J* = 8.7 Hz, $C_{3''}$, $C_{5''}$ nitrophenyl-H), 7.54 (d, 2H, *J* = 7.8 Hz, $C_{2'}$, $C_{6'}$ phenyl-H), 7.45 (d, 2H, *J* = 8.7 Hz, $C_{2''}$,$C_{6''}$ nitrophenyl-H), 7.24 (t, 2H, *J* = 7.8 Hz, $C_{3'}$, $C_{5'}$ phenyl-H), 7.00 (t, 1H, *J* = 7.5 Hz, $C_{4'}$ phenyl-H), 5.10 (s, 1H, DHP C_4-H), 2.23-2.22 (m, 2H, cyclohexanone C_8-H), 2.06 (s, 3H, DHP-CH_3), 1.90-1.80 (2×m, 2H, cyclohexanone C_7-H). IR (KBr) ν (cm^{-1}): 3322 (DHP N-H), 3078 (C-H, aromatic), 2943 (C-H, aliphatic), 1671 (C=O, ketone), 1617 (C=O, amide), 1601 (C=C, aromatic) 1507, 1386 (C-NO_2 aromatic); MS m/z (%):404.10 (25) $[M+2]^+$, 403.10 (98) [M],311.10 (100), 281.10 (91), 265.00 (18), 188.00 (25), 93.00 (48). Anal. Calcd. C, 68.47; H, 5.25; N, 10.42; Found: C, 68.32; H, 5.16; N, 10.31 (%).

3.1.2.3. 2-methyl-4-(2-nitrophenyl)-5-oxo-N-phenyl-1,4,5,6,7,8-hexahydroquinoline-3-carboxamide (**1c**)

Yield 42%; white powder; mp. 242℃; δ (ppm): δ ^{1}H NMR (300MHz, DMSO-d_6) δ: 9.65 (s, 1H, amide-NH), 8.93 (s, 1H, DHP-NH), 7.64 (d, 1H, *J* = 7.8 Hz, $C_{3''}$ nitrophenyl-H), 7.60 (d, 1H, *J* = 7.8 Hz, $C_{6''}$ nitrophenyl-H), 7.55-7.49 (m, 3H, $C_{5''}$ nitrophenyl-H, $C_{2'}$, $C_{6'}$ phenyl-H), 7.33-7.28 (m, 1H, $C_{4''}$ nitrophenyl-H), 7.23 (t, 2H, *J* = 7.8 Hz, $C_{3'}$, $C_{5'}$ phenyl-H), 6.98 (t, 1H, *J* = 7.5 Hz, $C_{4'}$ phenyl-H), 5.56 (s, 1H, DHP-C_4-H), 2.47-2.43 (m, 2H, cyclohexanone C_6-H), 2.14- 2.08 (m, 5H, cyclohexanone C_8-H, DHP-CH_3), 1.87-1.70 (2×m, 2H, cyclohexanone C_7-H). IR (KBr) ν (cm^{-1}): 3269 (DHP N-H), 3066 (C-H, aromatic), 2951 (C-H, aliphatic), 1736 (C=O, ketone), 1669 (C=O, amide), 1602 (C=C, aromatic) 1520, 1354 (C-NO_2 aromatic); MS m/z (%): 403.10 (5) [M], 386.10 (100), 355.10 (25), 328.10 (24), 281.10 (30), 250.10 (72), 188.00 (17). Anal. Calcd. C, 68.47; H, 5.25; N, 10.42; Found: C, 68.36; H, 5.17; N, 10.29 (%).

3.1.2.4. 2-methyl-5-oxo-N,4-diphenyl-1,4,5,6,7,8-hexahydroquinoline-3-carboxamide (**1f**)

Yield 74%; white powder; mp. 276℃; ^{1}H NMR (300MHz, DMSO-d_6) δ (ppm): δ 7.55 (d, 2H, *J* = 7.5 Hz, $C_{2'}$, $C_{6'}$phenyl-H), 7.24 (t, 2H, *J* = 7.8 Hz, $C_{3'}$, $C_{5'}$ phenyl-H), 7.18- 7.17 (m, 4H, $C_{2''}$, $C_{3''}$, $C_{5''}$, $C_{6''}$ phenyl-H), 7.09-7.05 (m, ^{1}H, $C_{4'}$ phenyl-H), 6.98 (t, 1H, *J* = 7.5 Hz, $C_{4''}$ phenyl-H), 4.99 (s, 1H, DHP C_4-H), 2.21-2.17 (m, 2H, cyclohexanone C_8-H), 2.04 (s, 3H, DHP-CH_3), 1.91- 1.78 (2×m, 2H, cyclohexanone C_7-H). IR (KBr) ν (cm^{-1}): 3227 (DHP N-H), 3071 (C-H, aromatic), 2954 (C-H, aliphatic), 1666 (C=O, ketone), 1629 (C=O, amide), 1607 (C=C, aromatic); MS m/z (%): 360.20 (3) $[M+2]^+$, 359.20 (23) $[M+1]^+$, 358.20 (87) [M], 281.20 (100), 266.10 (98), 238.10 (12), 188.00 (17). Anal. Calcd. C, 77.07; H, 6.19; N, 7.82; Found: C, 76.87; H, 6.02; N, 7.68 (%).

3.1.2.5. N-(4-chlorophenyl)-2-methyl-4-(3-nitrophenyl)-5-oxo-1,4,5,6,7,8-hexahydroquinoline-3-carboxamide (**2d**)

Yield 51%; yellow powder; mp. 209℃; ^{1}H NMR (300MHz, DMSO-d_6) δ (ppm): δ 9.80 (s, 1H amide-NH), 9.01 (s, 1H, DHP-NH), 7.99-7.95 (m, 2H, *J* = 8.1 Hz, *J* = 1.8 Hz, $C_{2''}$, $C_{4''}$ nitrophenyl-H), 7.63-7.48 (m, 4H, $C_{6''}$, $C_{5''}$ nitrophenyl-H, $C_{2'}$, $C_{6'}$ chlorophenyl-H), 7.29 (d, 2H, $C_{3'}$, $C_{5'}$ chlorophenyl-H), 5.12 (s, 1H, DHP C_4-H), 2.25-2.21 (m, 2H, cyclohexanone C_8-H), 2.08 (s, 3H, DHP-CH_3), 1.92-1.79 (2×m, 2H, cyclohexanone C_7-H). IR (KBr) ν (cm^{-1}): 3291 (DHP N-H), 3073 (C-H, aromatic), 2947 (C-H, aliphatic), 1731 (C=O, ketone), 1681 (C=O, amide), 1588 (C=C, aromatic), 1523, 1351 (C-NO_2 aromatic), 814.1 (C-Cl); MS m/z (%): 439.10 (3) $[M+2]^+$, 437.10 (14) [M], 422.10 (12), 315.10 (28), 311.10 (100), 309.10 (70), 235.10 (31), 188.00 (8), 162.10(63). Anal. Calcd. C, 63.09; H, 4.60; N, 9.60; Found: C, 62.83; H, 4.43; N, 9.43 (%).

3.1.2.6. N-(4-chlorophenyl)-2-methyl-4-(4-nitrophenyl)-5-oxo-1,4,5,6,7,8-hexahydroquinoline-3-carboxamide (**2e**)

Yield 39%; pale yellow powder; mp. 242℃; ^{1}H NMR (300MHz, DMSO-d_6) δ (ppm): δ 9.80 (s, 1H, amide-NH), 8.99 (s, 1H, DHP-NH), 8.08 (d, 2H, *J* = 8.7 Hz, $C_{3''}$, $C_{5''}$ nitrophenyl-H), 7.58 (d, 2H, *J* = 9.0

Hz, $C_{2'}$, $C_{6'}$ chlorophenyl-H), 7.42 (d, 2H, *J* = 9.0 Hz, $C_{3'}$, $C_{5'}$ chlorophenyl-H), 7.30 (d, 2H, *J* = 8.7Hz, $C_{2''}$, $C_{6''}$ nitrophenyl-H), 5.11 (s, ^{1}H, DHP C_4-H), 2.22-2.18 (m, 2H, cyclohexanone C_8-H), 2.06 (s, 3H, DHP-CH_3), 1.91-1.80 (2×m, 2H, cyclohexanone C_7-H). IR (KBr) ν (cm^{-1}): 3291 (DHP N-H), 3074 (C-H, aromatic), 2942 (C-H, aliphatic), 1682 (C=O, ketone), 1655 (C=O, amide), 1580 (C=C, aromatic), 1517, 1343 (C-NO_2 aromatic), 814 (C-Cl); MS m/z (%):439.10 (12) $[M+2]^+$, 437.10 (42) [M], 422.10 (2), 315 .10(27), 311.10 (79), 309.10 (100), 235.00 (31), 188.00 (19), 162.10 (27). Anal. Calcd. C, 63.09; H, 8.10; N, 9.60; Found: C, 62.79; H, 8.01; N, 9.46 (%).

3.1.2.7. N-(4-chlorophenyl)-2-methyl-4-(2-nitrophenyl)-5-oxo-1,4,5,6,7,8-hexahydroquinoline-3-carboxamide (**2c**)

Yield 56%; yellow powder; mp. 269℃; ^{1}H NMR (300MHz, DMSO-d_6) δ (ppm): δ 9.82 (s, 1H, amide-NH), 7.64-7.56 (m, 4H, $C_{3''}$, $C_{5''}$ nitrophenyl-H, $C_{6'}$, $C_{2'}$ chlorophenyl-H), 7.50 (d, 1H, *J* = 7.8 Hz, $C_{6''}$ nitrophenyl-H), 7.33-7.25 (m, 3H, $C_{4''}$ nitrophenyl-H, $C_{3'}$, $C_{5'}$ chlorophenyl-H), 5.53 (s, 1H, DHP C_4-H), 2.46-2.43 (m, 2H, cyclohexanone C_6-H), 2.10-2.06 (m, 5H, cyclohexanone C_8-H, DHP-CH_3), 1.85-1.71 (2m, 2H, cyclohexanone C_7-H). ^{13}C NMR (75 MHz, DMSO) δ: 194.29, 166.90, 152.74, 148.35, 141.62, 138.65, 136.42, 133.57, 131.77, 129.28, 128.83, 127.46, 126.96, 123.50, 121.33, 109.92, 36.83, 33.88, 26.68, 21.29, 17.33. IR (KBr) ν (cm^{-1}): 3264 (DHP N-H), 3075 (C-H, aromatic), 2950 (C-H, aliphatic), 1678 (C=O, ketone), 1641 (C=O, amide), 1601 (C=C, aromatic), 1528, 1385 (C-NO_2 aromatic), 837 (C-Cl); MS m/z (%):439.10 (2) $[M+2]^+$, 437.10 (6) [M], 422.10 (24), 420.10 (70), 315.10 (16), 261.10 (100), 235.00 (43), 188.00 (18), 160.00 (11). Anal. Calcd. C, 63.09; H, 4.60; N, 9.60; Found: C, 62.75; H, 4.47; N, 9.48; (%).

3.1.2.8. N-(4-chlorophenyl)-2-methyl-5-oxo-4-phenyl-1,4,5,6,7,8-hexahydroquinoline-3-carboxamide (**2f**)

Yield 72%; white powder; mp. 154℃; ^{1}H NMR (300MHz, DMSO-d_6) δ (ppm): δ 9.70 (s, 1H, amide-NH), 8.81 (s, 1H, DHP-NH), 7.60 (dd, 2H, *J* = 9.0 Hz, *J* = 1.7 Hz, $C_{2'}$, $C_{6'}$ chlophenyl-H), 7.31-7.28 (m,

2H, $C_{3'}$, $C_{5'}$ chlorophenyl-H), 7.21-7.13 (m, 4H, $C_{2''}$, $C_{3''}$, $C_{5''}$, $C_{6''}$ phenyl-H),7.09-7.06 (m, ^{1}H, $C_{4''}$ phenyl-H), 4.99 (s, 1H, DHP C_4-H), 2.21-2.18 (m, 2H, cyclohexanone C_8-H), 2.04 (s, 3H, DHP-CH_3), 1.91-1.80 (2m, 2H, cyclohexanone C_7-H). IR (KBr) ν (cm^{-1}): 3176 (DHP N-H), 3054 (C-H, aromatic), 2952 (C-H, aliphatic), 1662 (C=O, ketone), 1605 (C=O, amide), 821 (C-Cl); MS m/z (%): 394.20 (13) $[M+2]^+$, 392.20 (36) [M], 377.20 (3), 315.10 (50), 266.10 (100), 238.10 (9), 188.10 (13), 160.10(10). Anal. Calcd. C, 70.31; H, 5.39; N, 7.13; Found: C, 70.13; H, 5.26; N, 7.01 (%).

3.1.2.9. 2-methyl-4-(3-nitrophenyl)-N-(4-nitrophenyl)-5-oxo-1,4,5,6,7,8-hexahydroquinoline-3-carboxamide (**3d**)

Yield 37%; yellow powder; mp. 242℃; ^{1}H NMR (300MHz, DMSO-d_6) δ (ppm): δ 8.16 (d, 2H, *J* = 9.3 Hz, $C_{3'}$, $C_{5'}$ nitrophenyl-H), 7.99-7.96 (m, 2H, $C_{2''}$, $C_{4''}$ nitrophenyl-H), 7.80 (d, 2H, *J* = 9.3 Hz $C_{2'}$, $C_{6'}$ nitrophenyl-H), 7.62 (d, 1H, *J* = 7.8 Hz, $C_{6''}$ nitrophenyl-H), 7.52 (t, 1H, *J* = 7.8 Hz, $C_{5''}$ nitrophenyl-H), 5.16 (s, 1H, DHP C_4-H), 2.25-2.21 (m, 2H, cyclohexanone C_8-H), 2.11 (s, 3H, DHP-CH_3), 1.99-1.80 (2×m, 2H, cyclohexanone C_7-H). IR (KBr) ν (cm^{-1}): 3272 (DHP N-H), 3069 (C-H, aromatic), 2948 (C-H, aliphatic), 1681 (C=O, ketone), 1655 (C=O, amide), 1609 (C=C, aromatic), 1533, 1335 (C-NO_2 aromatic); MS m/z (%): 449.10 (3) $[M+1]^+$, 448.10 (13) [M], 432 .10(16), 431.10 (59), 326 .10(100), 311.10 (68), 267 .10(12), 188.00 (14), 162.00 (34). Anal. Calcd. C, 61.60; H, 4.50; N, 12.49; Found: C, 61.38; H, 4.26; N, 12.32 (%).

3.1.2.10. 2-methyl-N,4-bis(4-nitrophenyl)-5-oxo-1,4,5,6,7,8-hexahydroquinoline-3-carboxamide (**3e**)

Yield 46%; pale yellow powder; mp. 268℃; ^{1}H NMR (300MHz, DMSO-d_6) δ (ppm): δ 10.27 (s, 1H, amide-NH), 9.09 (s, 1H, DHP-NH), 8.16 (d, 2H, *J* = 9.3 Hz, $C_{3'}$, $C_{5'}$ nitrophenyl-H), 8.08 (d, 2H, *J* = 8.7 Hz, $C_{3''}$, $C_{5''}$ nitrophenyl-H), 7.81 (d, 2H, *J* = 9.3 Hz, $C_{2'}$, $C_{6'}$ nitrophenyl-H), 7.43 (d, 2H, *J* = 8.7 Hz, $C_{2''}$, $C_{6''}$ nitrophenyl-H), 5.15 (s, 1H, DHP C_4-H), 2.25-2.21 (m, 2H, cyclohexanone C_8-H), 2.10 (s, 3H, DHP-CH_3), 1.92-1.81 (2×m, 2H, cyclohexanone C_7-H). ^{13}C NMR (75 MHz, DMSO) δ: 194.71, 168.07, 154.80,

153.22, 146.21, 145.92, 142.45, 138.21, 129.02, 125.23, 123.84, 119.48, 109.10, 109.00, 38.60, 37.14, 26.74, 21.26, 17.67. IR (KBr) ν (cm^{-1}): 3253 (DHP N-H), 3071 (C-H, aromatic), 2965 (C-H, aliphatic), 1680 (C=O, ketone), 1652 (C=O, amide), 1610 (C=C, aromatic), 1530, 1346 (C-NO_2 aromatic); MS m/z (%): 450.10 (2) $[M+2]^+$,449.10 (10) $[M+1]^+$, 448.10 (39) [M], 431.10 (30), 326 .10 (100), 311.10 (81), 267.10 (13), 235.00(29), 188.00 (19), 162.00 (21). Anal. Calcd. C, 61.60; H, 4.50; N, 12.49; Found: C, 61.46; H, 4.34; N, 12.31(%).

3.1.2.11. 2-methyl-4-(2-nitrophenyl)-N-(4-nitrophenyl)-5-oxo-1,4,5,6,7,8-hexahydroquinoline-3-carboxamide (**3c**)

Yield 56%; orange powder; mp. 230℃; ^{1}H NMR (300MHz, DMSO-d_6) δ (ppm): δ 9.65 (s, 1H, amide-N<u>H</u>), 8.98 (s, 1H, DHP-N<u>H</u>), 7.83 (d, 2H, *J* = 8.7 Hz, $C_{3'}$, $C_{5'}$ nitrophenyl-<u>H</u>), 7.68-7.59 (m, 4H, $C_{3''}$, $C_{5''}$ nitrophenyl-<u>H</u>, $C_{6'}$, $C_{2'}$ nitrophenyl-<u>H</u>), 7.50 (d, 1H *J* = 7.8 Hz, $C_{6''}$ nitrophenyl-<u>H</u>), 7.33-7.28 (m, 1H, $C_{4''}$ nitrophenyl-<u>H</u>), 5.56 (s, 1H, DHP C_4-<u>H</u>), 2.47-2.43 (m, 2H, cyclohexanone C_6-<u>H</u>), 2.14-2.08 (m, 5H, cyclohexanone C_8-<u>H</u>, 3H, DHP-<u>CH_3</u>), 1.85- 1.69 (2×m, 2H, cyclohexanone C_7-<u>H</u>). IR (KBr) ν (cm^{-1}): 3269 (DHP N-H), 3066 (C-H, aromatic), 2951 (C-H, aliphatic), 1673 (C=O, ketone, amide), 1602 (C=C, aromatic), 1519, 1384 (C-NO_2 aromatic); MS m/z (%): 450.10 (1) $[M+2]^+$, 449.10 (9) $[M+1]^+$, 448.10 (39) [M], 431.10 (30), 416.10 (11), 326.10 (100), 309.10 (85), 235.00 (25), 188.00 (22), 162.00 (19). Anal. Calcd. C, 61.60; H, 4.50; N, 12.49; Found: C, 61.37; H, 4.31; N, 12.29 (%).

3.1.2.12. 4-(2-methyl-4-(3-nitrophenyl)-5-oxo-1,4,5,6,7,8-hexahydroquinoline-3-carboxamido)benzoic acid (**4d**)

Yield 57%; yellow powder; mp. 240℃; ^{1}H NMR (300MHz, DMSO-d_6) δ (ppm): δ 9.97 (s, 1H, -<u>OH</u>), 9.05 (s, 1H, amide-N<u>H</u>), 7.99- 7.95 (m, 2H, $C_{2''}$, $C_{4''}$ nitrophenyl-<u>H</u>), 7.83 (d, 2H, *J* = 8.7 Hz, $C_{3'}$, $C_{5'}$ benzoic acid-<u>H</u>), 7.67-7.61 (m, 3H, $C_{2'}$, $C_{6'}$ benzoic acid-H, $C_{6''}$ nitrophenyl-<u>H</u>), 7.51 (t, ^{1}H, *J* = 7.5 Hz, $C_{5''}$ nitrophenyl-<u>H</u>), 5.14 (s, ^{1}H, DHP C_4-<u>H</u>), 2.22-2.20 (m, 2H, cyclohexanone C_8-<u>H</u>), 2.09 (s, 3H, DHP-<u>CH_3</u>), 1.92- 1.80 (2×m, 2H, cyclohexanone C_7-<u>H</u>). IR (KBr) ν (cm^{-1}): 3435 (O-H), 3201 (DHP N-H),

3074 (C-H, aromatic), 2945 (C-H, aliphatic), 1688 (C=O, ketone, acid), 1601 (C=C, aromatic), 1526, 1385 (C-NO_2 aromatic); MS m/z (%): 447.10 (14) [M], 430.10 (56), 431.20 (30), 325.10 (61), 311.10 (75), 267.10 (27), 237.10 (18), 188.00 (15), 162.10 (100). Anal. Calcd. C, 64.42; H, 4.73; N, 9.39; Found: C, 64.31; H, 4.57; N, 9.23 (%).

3.1.2.13. 4-(2-methyl-4-(4-nitrophenyl)-5-oxo-1,4,5,6,7,8-hexahydroquinoline-3-carboxamido)benzoic acid (**4e**)

Yield 48%; yellow powder; mp. 264℃; ^{1}H NMR (300MHz, DMSO-d_6) δ (ppm): δ 9.98 (s, 1H, -OH), 9.03 (s, 1H, amide-NH), 8.31 (s, 1H, DHP-NH), 8.08 (d, 2H, *J* = 8.7 Hz, $C_{3''}$, $C_{5''}$ nitrophenyl-H), 7.83 (d, 2H, *J* = 8.7 Hz, $C_{3'}$, $C_{5'}$ benzoic acid-H), 7.67 (d, 2H, *J* = 8.7 Hz, $C_{2'}$, $C_{6'}$ benzoic acid-H), 7.42 (d, 2H, *J* = 8.7Hz, $C_{2''}$, $C_{6''}$ nitrophenyl-H), 5.13 (s, ^{1}H, DHP C_4-H), 2.23-2.19 (m, 2H, cyclohexanone C_8-H), 2.08 (s, 3H, DHP-CH_3), 1.91-1.80 (2m, 2H, cyclohexanone C_7-H). IR (KBr) ν (cm^{-1}): 3278 (O-H), 3204 (DHP N-H), 3066 (C-H, aromatic), 2941 (C-H, aliphatic), 1680 (C=O, ketone, acid), 1654 (C=O, amide), 1608 (C=C, aromatic), 1516, 1344 (C-NO_2 aromatic); MS m/z (%): 448.10 (3) $[M+1]^+$, 430.10 (50), 325.10 (53), 311.10 (63), 267.10 (25), 237.10 (18), 188.00 (13), 162.10 (100). Anal. Calcd. C, 64.42; H, 4.73; N, 9.39; Found: C, 64.26; H, 4.53; N, 9.29 (%).

3.1.2.14. 4-(2-methyl-4-(2-nitrophenyl)-5-oxo-1,4,5,6,7,8-hexahydroquinoline-3-carboxamido)benzoic acid (**4c**)

Yield 61%; yellow powder; mp. 230℃; ^{1}H NMR (300MHz, DMSO-d_6) δ (ppm): δ 10.00 (s, 1H, -OH), 8.98 (s, 1H, amide-NH), 8.31 (s, 1H, DHP-NH), 7.83 (d, 2H, *J* = 8.7 Hz, $C_{3'}$, $C_{5'}$ benzoic acid-H), 7.68- 7.59 (m, 4H, $C_{3''}$, $C_{5''}$ nitrophenyl-H, $C_{6'}$, $C_{2'}$ benzoic acid-H), 7.50 (d, ^{1}H, *J* = 7.8 Hz, $C_{6''}$ nitrophenyl-H), 7.33-7.28 (m, 1H, $C_{4''}$ nitrophenyl-H), 5.56 (s, 1H, DHP C_4-H), 2.46-2.44 (m, 2H, C6 cyclohexanone-H), 2.15- 2.03 (m, 5H, cyclohexanone C_8-H, DHP-CH_3), 1.86- 1.71 (2×m, 2H, cyclohexanone C_7-H). IR (KBr) ν (cm^{-1}): 3375 (O-H), 3310 (DHP N-H), 3178 (C-H, aromatic), 2945 (C-H, aliphatic), 1679 (C=O, ketone, acid, amide), 1606

(C=C, aromatic), 1530, 1383 (C-NO_2 aromatic); MS m/z (%): 448.16 (4) $[M+1]^+$, 430.10 (68), 325.10 (76), 311.10 (88), 267.10 (29), 188.00 (20), 162.10 (100). Anal. Calcd. C, 64.42; H, 4.73; N, 9.39; Found: C, 64.26; H, 4.54; N, 9.21 (%).

3.1.2.15. N-(4-methoxyphenyl)-2-methyl-4-(3-nitrophenyl)-5-oxo-1,4,5,6,7,8-hexahydroquinoline-3-carboxamide (**5d**)

Yield 82%; pale yellow powder; mp. 172℃; ^{1}H NMR (300MHz, DMSO-d_6) δ (ppm): δ 9.53 (s, 1H, amide-N<u>H</u>), 8.94 (s, 1H, DHP-N<u>H</u>), 8.00-7.95 (m, 2H, $C_{2''}$, $C_{4''}$ nitrophenyl-<u>H</u>), 7.63 (d, 1H, *J* = 7.2 Hz, $C_{6''}$ nitrophenyl-<u>H</u>), 7.51 (t, 1H, *J* = 7.8 Hz, $C_{5''}$ nitrophenyl-<u>H</u>), 7.39 (d, 2H, *J* = 8.7 Hz, $C_{2'}$, $C_{6'}$methoxyphenyl-<u>H</u>), 6.82 (d, 2H, *J* = 8.7 Hz, $C_{5'}$, $C_{3'}$ methoxyphenyl-<u>H</u>), 5.10 (s, 1H, DHP C_4-<u>H</u>), 3.69 (s, 3H, -<u>OCH_3</u>), 2.21-2.20 (m, 2H, cyclohexanone C_8-<u>H</u>), 2.07 (s, 3H, DHP-<u>CH_3</u>), 1.91-1.79 (2×m, 2H, cyclohexanone C_7-<u>H</u>). IR (KBr) ν (cm^{-1}): 3241 (DHP N-H), 3083 (C-H, aromatic), 2953 (C-H, aliphatic), 1670 (C=O, ketone, amide), 1604 (C=C, aromatic), 1522, 1345 (C-NO_2 aromatic), 1234 (C-O); MS m/z (%): 435.20 (2) $[M+2]^+$, 434.20 (10) $[M+1]^+$, 433.20 (36) [M], 416.20 (42), 311.10 (62), 294.10 (11), 264.10 (10), 123.10 (100).

Anal. Calcd. C, 66.50; H, 5.35; N, 9.69; Found: C, 66.35; H, 5.27; N, 9.52 (%).

3.1.2.16. N-(4-methoxyphenyl)-2-methyl-4-(4-nitrophenyl)-5-oxo-1,4,5,6,7,8-hexahydroquinoline-3-carboxamide (**5e**)

Yield 85%; yellow powder; mp. 249℃; ^{1}H NMR (300MHz, DMSO-d_6) δ (ppm): δ 9.52 (s, 1H, amide-N<u>H</u>), 8.92 (s, 1H, DHP-N<u>H</u>), 8.08 (d, 2H, *J* = 8.7 Hz, $C_{3''}$, $C_{5''}$ nitrophenyl-<u>H</u>), 7.45-7.41 (m, 4H, $C_{2'}$, $C_{6'}$ chlorophenyl, $C_{2''}$, $C_{6''}$ nitrophenyl-H), 6.82 (d, 2H, *J* = 9.0 Hz, $C_{3'}$, $C_{5'}$ chlorophenyl-<u>H</u>), 5.09 (s, 1H, DHP C_4-<u>H</u>), 3.69 (s, 3H, -O<u>CH_3</u>), 2.20-2.19 (m, 2H, cyclohexanone C_8-<u>H</u>), 2.05 (s, 3H, DHP-<u>CH_3</u>), 1.90- 1.78 (2×m, 2H, cyclohexanone C_7-<u>H</u>). IR (KBr) ν (cm^{-1}): 3306 (DHP N-H), 3077 (C-H, aromatic), 2996 (C-H, aliphatic), 1673 (C=O ketone), 1628 (C=O amide), 1614 (C=C, aromatic), 1508, 1339 (C-NO_2 aromatic), 1227 (C-O); MS m/z (%): 434.20 (4) $[M+1]^+$, 433.20 (16) [M], 401.20 (13), 309.10 (100),

279.10 (20), 235.10 (39), 162.10 (26), 123.00 (36). Anal. Calcd. C, 66.50; H, 5.35; N, 9.69; Found: C, 66.41; H, 5.19; N, 9.46 (%).

3.1.2.17.N-(4-methoxyphenyl)-2-methyl-4-(2-nitrophenyl)-5-oxo-1,4,5,6,7,8-hexahydroquinoline-3-carboxamide (**5c**)

Yield 74%; orange powder; mp. 170℃; ^{1}H NMR (300MHz, DMSO-d_6) δ (ppm): δ 9.50 (s, 1H, amide-NH), 8.91 (s, 1H, DHP-NH), 7.63 (d, 1H, *J* = 7.2 Hz, $C_{3''}$ nitrophenyl-H), 7.61-7.57 (m, 1H, $C_{5''}$nitrophenyl-H), 7.51 (d, 1H, *J* = 7.8 Hz, $C_{6''}$ nitrophenyl-H), 7.43 (d, 2H, *J* = 9.0 Hz, $C_{6'}$, $C_{2'}$ methoxyphenyl-H), 7.33-7.28 (m, 1H, $C_{4''}$, nitrophenyl-H), 6.81 (d, 2H, *J* = 9.0 Hz, $C_{3'}$, $C_{5'}$ chlorophenyl-H), 5.54 (s, 1H, DHP C_4-H), 3.69 (s, 3H, -OCH_3), 2.50-2.08 (m, 5H, cyclohexanone C_8-H, DHP-CH_3), 1.87-1.67 (2×m, 2H, cyclohexanone C_7-H). ^{13}C NMR (75 MHz, DMSO) δ: 194.26, 166.37, 155.57, 152.77, 148.35, 141.75, 136.07, 133.55, 132.88, 131.78, 127.40, 123.51, 121.51, 114.10, 109.97, 79.62, 55.61, 36.83, 33.89, 26.70, 21.30, 17.40. IR (KBr) ν (cm^{-1}): 3264 (DHP N-H), 3055 (C-H, aromatic), 2936 (C-H, aliphatic), 1740 (C=O ketone), 1667 (C=O amide), 1699 (C=C, aromatic), 1520, 1383 (C-NO_2 aromatic), 1241 (C-O); MS m/z (%): 433.20 (4) [M], 416.20 (30), 399.20 (46), 383.20 (35), 277.10 (39), 261.10 (100), 235.10 (40), 123.00 (17). Anal. Calcd. C, 66.50; H, 5.35; N, 9.69; Found: C, 66.34; H, 5.25; N, 9.41(%).

3.1.2.18. N-(4-cyanophenyl)-2-methyl-4-(3-nitrophenyl)-5-oxo-1,4,5,6,7,8-hexahydroquinoline-3-carboxamide (**6d**)

Yield 78%; pale yellow powder; mp. 238℃; ^{1}H NMR (300MHz, DMSO-d_6) δ (ppm): δ 10.09 (s, 1H, amide-NH), 9.09 (s, 1H, DHP-NH), 8.32-7.93 (m, 2H, $C_{2''}$, $C_{4''}$ nitrophenyl-H), 7.75-7.68 (m, 4H, $C_{2'}$,$C_{3'}$, $C_{5'}$, $C_{6'}$ cyanophenyl-H), 7.62 (d, 1H, *J* = 7.8 Hz, $C_{6''}$ nitrophenyl-H), 7.51 (t, 1H, *J* = 7.5 Hz , $C_{5''}$ nitrophenyl-H), 5.14 (s, 1H, DHP C_4-H), 2.23-2.20 (m, 2H, cyclohexanone C_8-H), 2.09 (s, 3H, DHP-CH_3), 1.92-1.80 (2×m, 2H, cyclohexanone C_7-H). IR (KBr) ν (cm^{-1}): 3280 (DHP N-H), 3066 (C-H, aromatic), 2950 (C-H, aliphatic), 2220 (C≡N), 1682 (C=O ketone), 1640 (C=O amide), 1604 (C=C,

aromatic), 1526, 1352 (C-NO_2 aromatic); MS m/z (%): 429.20 (5) $[M+1]^+$, 411.20 (64), 311.10 (96), 306.10 (87), 267.10 (34), 237.10 (20), 162.10 (100). Anal. Calcd. C, 67.28; H, 4.71; N, 13.08; Found: C, 67.13; H, 4.56; N, 12.84 (%).

3.1.2.19. N-(4-cyanophenyl)-2-methyl-4-(4-nitrophenyl)-5-oxo-1,4,5,6,7,8-hexahydroquinoline-3-carboxamide (**6e**)

Yield 83%; pale yellow powder; mp. 257℃; ^{1}H NMR (300MHz, DMSO-d_6) δ (ppm): δ 10.11 (s, 1H, amide-N<u>H</u>), 9.08 (s, 1H, DHP-N<u>H</u>), 8.08 (d, 2H, *J* = 8.7 Hz, $C_{3''}$, $C_{5''}$ nitrophenyl-<u>H</u>), 7.76-7.68 (m, 4H, $C_{2'}$, $C_{6'}$, $C_{3'}$, $C_{5'}$ cyanophenyl-<u>H</u>), 7.42 (d, 2H, *J* = 8.4 Hz, $C_{2''}$, $C_{6''}$ nitrophenyl-<u>H</u>), 5.13 (s, 1H, DHP C_4-<u>H</u>), 2.25-2.20 (m, 2H, cyclohexanone C_8-<u>H</u>), 2.08 (s, 3H, DHP-<u>CH_3</u>), 1.91-1.80 (2×m, 2H, cyclohexanone C_7-<u>H</u>). ^{13}C NMR (75 MHz, DMSO) δ 194.68, 167.90, 154.81, 153.40, 153.28, 146.19, 143.86, 137.69, 133.50, 129.03, 123.83, 119.89, 119.59, 108.88, 105.13, 38.65, 37.14, 26.76, 21.27, 17.61. IR (KBr) ν (cm^{-1}): 3278 (DHP N-H), 3072 (C-H, aromatic), 2943 (C-H, aliphatic), 2221 (C≡N), 1655 (C=O ketone), 1682 (C=O amide), 1604 (C=C, aromatic), 1582, 1346 (C-NO_2 aromatic); MS m/z (%): 429.20 (3) $[M+2]^+$, 428.20 (10) $[M+1]^+$, 396.20 (7), 311.10 (96), 309.10 (100), 284.10 (13), 235.10 (24), 162.10 (31). Anal. Calcd. C, 67.28; H, 4.71; N, 13.08; Found: C, 67.12; H, 4.53; N, 12.73 (%).

3.1.2.20. N-(4-cyanophenyl)-2-methyl-4-(2-nitrophenyl)-5-oxo-1,4,5,6,7,8-hexahydroquinoline-3-carboxamide (**6c**)

Yield 69%; yellow powder; mp. 270℃; ^{1}H NMR (300MHz, DMSO-d_6) δ (ppm): δ 10.15 (s, 1H, amide-N<u>H</u>), 9.01 (s, 1H, DHP-N<u>H</u>), 7.76-7.68 (m, 4H, $C_{3''}$,$C_{5''}$ nitrophenyl-<u>H</u>, $C_{2'}$, $C_{6'}$cyanophenyl-<u>H</u>), 7.68-7.59 (m, 2H, $C_{3'}$, $C_{5'}$cyanophenyl-<u>H</u>), 7.51 (d, 1H, *J* = 7.5 Hz, $C_{6''}$ nitrophenyl-<u>H</u>), 7.33-7.28 (m, 1H, $C_{3''}$ nitrophenyl-<u>H</u>), 5.55 (s, 1H, DHP C_4-<u>H</u>), 2.15-2.09 (m, 2H, cyclohexanone C_8-<u>H</u>), 2.06 (s, 3H, DHP-<u>CH_3</u>), 1.86-1.72 (2×m, 2H, cyclohexanone C_7-<u>H</u>). IR (KBr) ν (cm^{-1}): 3310 (DHP N-H), 3076 (C-H, aromatic), 2948 (C-H, aliphatic), 2228 (C≡N), 1673 (C=O ketone), 1631 (C=O amide), 1604 (C=C, aromatic), 1530, 1352 (C-NO_2 aromatic); MS m/z (%):429.20 (5) $[M+1]^+$, 428.20 (18) [M], 411.20 (64),

311.10 (96), 309.10 (87), 267.10 (34), 237.10 (20), 162.10 (100).Anal. Calcd. C, 67.28; H, 4.71; N, 13.08; Found: C, 67.09; H, 4.59; N, 12.90 (%).

3.1.2.21. N,N-diethyl-2-methyl-4-(3-nitrophenyl)-5-oxo-1,4,5,6,7,8-hexahydroquinoline-3-carboxamide (**7d**)

Yield 18%; yellow powder; mp. 173℃; ^{1}H NMR (400MHz, $CDCl_3$) δ (ppm): δ 8.09 (t, 1H, *J* = 1.5 Hz $C_{2''}$ nitrophenyl-H), 8.10-8.09 (m, 1H, $C_{4''}$ nitrophenyl-H), 7.63 (d, 1H, *J* = 5.7 Hz, $C_{6''}$ nitrophenyl-H), 7.41 (t, 1H, *J* = 6.0 Hz, $C_{5''}$ nitrophenyl-H), 6.14 (s, 1H, DHP N-H), 4.96 (s, 1H, DHP C_4-H), 3.49 (t, 1H, *J* = 5.1 Hz, cyclohexanone C_6-H), 3.26-3.15 (m, 3H, C6 cyclohexanone-H, CH_3-CH_2-N), 2.50 (m, 2H, cyclohexanone C_8-H), 2.37-2.33 (m, 2H, CH_3-CH_2-N), 2.05-2.01 (m, 2H, cyclohexanone C_7-H), 1.64 (s, 3H, DHP-CH_3), 1.08 (s, 3H, CH_3-CH_2-N), 0.78-0.77 (m, 3H, CH_3-CH_2-N). IR (KBr) ν (cm^{-1}): 3272 (DHP N-H), 3069 (C-H, aromatic), 2948 (C-H, aliphatic), 1681 (C=O, ketone), 1655 (C=O, amide), 1609 (C=C, aromatic), 1533, 1335 (C-NO_2 aromatic) MS m/z (%): 384.30 (3) $[M+1]^+$, 383.20 (11) [M], 366.30 (100), 321.20 (14), 311.20 (8), 261 (60), 188.10 (26), 160.10 (10). Anal. Calcd. C, 65.78; H, 6.57; N, 10.96; Found: C, 65.62; H, 6.43; N, 10.78 (%).

3.1.2.22. N,N-diethyl-2-methyl-4-(4-nitrophenyl)-5-oxo-1,4,5,6,7,8-hexahydroquinoline-3-carboxamide (**7e**)

Yield 26%; yellow powder; mp. 139℃; ^{1}H NMR (300MHz, DMSO-d_6) δ (ppm): δ 8.83 (s, 1H, amide-NH), 8.09 (d, 2H, *J* = 8.7 Hz, $C_{3''}$, $C_{5''}$ nitrophenyl-H), 7.33 (d, 2H, *J* = 8.7 Hz, $C_{2''}$, $C_{6''}$ nitrophenyl-H), 4.72 (s, 1H, DHP C_4-H), 3.06-3.05 (m, 4H, 2 × CH_3-CH_2-N), 2.20-1.87 (m, 5H, cyclohexanone-H), 1.72 (s, 3H, DHP-CH_3), 0.96-0.59 (m, 6H, 2×CH_3-CH_2-N). IR (KBr) ν (cm^{-1}): 3288 (DHP N-H), 3069 (C-H, aromatic), 2972 (C-H, aliphatic), 1682 (C=O ketone), 1610 (C=O amide), 1584 (C=C, aromatic), 1514, 1382 (C-NO_2 aromatic); MS m/z (%):385.30 (3) $[M+2]^+$, 384.30 (22) $[M+1]^+$, 383.30 (93) [M], 368.20 (10), 311.20 (15), 282.20 (11), 261 (100), 188.10 (35), 160.10 (13). Anal. Calcd. C, 65.78; H, 6.57; N, 10.96; Found: C, 65.62; H, 6.39; N, 10.74 (%).

3.1.2.23. N,N-diethyl-2-methyl-4-(2-nitrophenyl)-5-oxo-1,4,5,6,7,8-hexahydroquinoline-3-carboxamide (**7c**)

Yield 30%; yellow powder; mp. 212℃; ^{1}H NMR (300MHz, DMSO-d_6) δ (ppm): δ 7.44- 7.34 (m, 2H, $C_{2''}$, $C_{5''}$ nitrophenyl-H), 7.22 (d, 1H, *J* = 8.7 Hz, $C_{6''}$ nitrophenyl-H), 7.10-7.07 (m, 1H, $C_{4''}$ nitrophenyl-H), 4.95 (s, 1H, DHP C_4-H), 2.95-2.61 (m, 2H, CH_3-CH_2-N), 2.24-2.22 (m, 2H, CH_3- CH_2-N), 1.92-1.49 (m, 8H, DHP-CH_3, 6H, cyclohexanone-H), 1.02-0.76 (m, 6H, 2×CH_3-CH_2-N). ^{13}C NMR (75 MHz, DMSO): δ 194.11, 168.88, 168.28, 153.77, 133.39, 131.77, 131.72, 127.14, 123.22, 110.85, 108.30, 36.81, 36.81, 34.09, 26.76, 21.34, 16.18, 14.66, 12.85. IR (KBr) ν (cm^{-1}): 3203 (DHP N-H), 3072 (C-H, aromatic), 2950 (C-H, aliphatic), 1679 (C=O ketone), 1613 (C=O amide), 1524, 1365 (C-NO_2 aromatic); MS m/z (%): 384.30 (2) $[M+1]^+$, 383.30 (8) [M], 366.30 (100), 321.20 (21), 308.20 (27), 261.20 (33), 235.10 (12), 188.10 (16), 160.10 (8). Anal. Calcd. C, 65.78; H, 6.57; N, 10.96; Found: C, 65.59; H, 6.35; N, 10.78 (%).

3.1.2.24. N,N-diethyl-2-methyl-5-oxo-4-phenyl-1,4,5,6,7,8-hexahydroquinoline-3-carboxamide (**3f**)

Yield 48%; white powder; mp. 220℃; ^{1}H NMR (300MHz, DMSO-d_6) δ (ppm): δ 8.63 (s, 1H, amide-NH), 7.19 (t, 2H, *J* = 7.5 Hz, $C_{3''}$, $C_{5''}$ phenyl-H), 7.11-7.04 (m, 3H, $C_{2''}$, $C_{4''}$, $C_{6''}$ phenyl-H), 4.58 (s, 1H, DHP C_4-H), 2.98-2.95 (m, 3H, CH_3-CH_2-N), 2.16-2.14 (m, 2H, cyclohexanone C_8-H), 1.90-1.87 (m, 2H, CH_3, cyclohexanone C_7-H), 1.68 (s, 3H, DHP-CH_3), 0.96 (m, 3H, CH_3-CH_2-N), 0.46 (m, 3H, CH_3-CH_2-N). IR (KBr) ν (cm^{-1}): 3262 (DHP N-H), 3105 (C-H, aromatic), 2989 (C-H, aliphatic), 1681 (C=O ketone), 1638 (C=O amide), 1623 (C=C, aromatic), 1586, 1379 (C-NO_2 aromatic); MS m/z (%): 340.30 (3) $[M+2]^+$, 339.30 (23) $[M+1]^+$, 338.30 (95) [M], 266.20 (22), 261.20 (100), 238.20 (14),188.10 (32), 160.10 (11). Anal. Calcd. C, 74.52; H, 7.74; N, 8.28; Found: C, 74.34; H, 7.53; N, 8.17(%).

3.1.2.25. N,N,2-trimethyl-4-(4-nitrophenyl)-5-oxo-1,4,5,6,7,8-hexahydroquinoline-3-carboxamide (**8e**)

Yield 16%; yellow powder; mp. 206℃; ^{1}H NMR (300MHz, DMSO-d_6) δ (ppm): δ 8.83 (s, 1H, amide-NH), 8.09 (d, 2H, *J* = 8.7 Hz, $C_{3''}$, $C_{5''}$, nitrophenyl-H), 7.32 (d, 2H, *J* = 8.7 Hz, $C_{2''}$, $C_{6''}$ nitrophenyl-H),

4.72 (s, 1H, DHP C_4-H), 2.72 (s, 3H, CH_3-N), 2.37 (s, 3H, CH_3-N), 2.22-2.15 (m, 2H, cyclohexanone C_8-H), 1.92-1.89 (m, 2H, cyclohexanone C_7-H), 1.67 (s, 3H, DHP-CH_3). IR (KBr) ν (cm^{-1}): 3253 (DHP N-H), 3071 (C-H, aromatic), 2965 (C-H, aliphatic), 1680 (C=O, ketone), 1652 (C=O, amide), 1610 (C=C, aromatic), 1530, 1346 (C-NO_2 aromatic); MS m/z (%): 357.20 (3) $[M+2]^+$, 356.20 (22) $[M+1]^+$, 355.20 (100) [M], 340.20 (13), 311.10 (13), 233.20 (98), 216.10 (16), 188.10 (48), 160.10 (15). Anal. Calcd. C, 64.21; H, 5.96; N, 11.82; Found: C, 64.03; H, 5.75; N, 11.71 (%).

3.1.2.26. N,N,2-trimethyl-5-oxo-4-phenyl-1,4,5,6,7,8-hexahydroquinoline-3-carboxamide (**8f**)

Yield 51%; white powder; mp. 221℃; ^{1}H NMR (300MHz, DMSO-d_6) δ (ppm): δ 8.65 (s, 1H, amide-NH), 7.20 (t, 2H, *J* = 7.5 Hz, $C_{3''}$, $C_{5''}$ phenyl-H), 7.10 (t, 1H, *J* = 7.2 Hz, $C_{4''}$ phenyl-H), 7.02 (d, 2H, *J* = 7.2 Hz, $C_{2''}$, $C_{6''}$ phenyl-H), 4.60 (s, 1H, DHP C_4-H), 2.73 (s, 3H, CH_3-N), 2.47-2.46 (m, 2H, cyclohexanone C_6-H), 2.37 (s, 3H, CH_3-N), 2.22-2.16 (m, 2H, cyclohexanone C_8-H), 1.92-1.90 (m, 2H, cyclohexanone C_7-H), 1.67 (s, 3H, DHP-CH_3). IR (KBr) ν (cm^{-1}): 3256 (DHP N-H), 3104 (C-H, aromatic), 2988 (C-H, aliphatic), 1736 (C=O ketone), 1680 (C=O amide), 1641 (C=C, aromatic), 1504, 1379 (C-NO_2 aromatic); MS m/z (%): 312.20 (2) $[M+2]^+$, 311.20 (18) $[M+1]^+$, 310.20 (83) [M], 266.10 (16), 233.20 (100), 209.10 (16), 188.10 (43), 160.10 (13). Anal. Calcd. C, 73.52; H, 7.14; N, 9.03; Found: C, 73.38; H, 7.02; N, 8.80 (%).