

QUANTITATIVE ESTIMATION OF PHYTO-CHEMICALS IN PATHADI GHRITA THROUGH HPLC METHOD

Dr. Aasha Kaushik¹, Dr. Satyawati Rathia², Dr. Bhupendra Kumar³, Dr. Atharva Ganeshrao Bore⁴, Dr. Gitesh Dewangan⁵, Dr. Rashmi⁶, Dr. Ragi Sahu⁷

¹MD Scholar, Dept. Of Kaumarbhritya, GAC Raipur, C.G. Email ID: aashakaushik93@gmail.com Orchid ID- 0009 0004 6590 0349

²Lecturer, Dept. Of Kaumarbhritya ,GAC Raipur, C.G. Email ID: satirathiya@gmail.com Orchid Id- 0009-0000-1547-4362

³MD Scholar, Dept. Of Kaumarbhritya, GAC Raipur, C.G. Email ID: bhupendrakumarlog@gmail.com Orchid Id- 0009-0002-9418-7410

⁴MD Scholar, Dept. Of Kaumarbhritya, GAC Raipur, C.G. Email ID: atharvasen123@gmail.com Orchid Id- 0009-0009-7862-8897

⁵MD Scholar, Dept. Of Kaumarbhritya, GAC Raipur, C.G. Email ID: 19gitesh@gmail.com Orchid Id- 0009-0002-0538-8051

⁶MD Scholar, Dept. Of Kaumarbhritya, GAC Raipur, C.G. Email ID: rashmikanwar100@gmail.com Orchid ID- 0009-0009-0643-6714

⁷MD Scholar, Dept. Of Kaumarbhritya, GAC Raipur, C.G. Email ID:ragisahu27@gmail.com Orchid ID- 0009-0009-7862-8897

ABSTRACT

Introduction: A traditional Ayurvedic remedy called Pathadi Ghrita is recommended for neurological conditions and Medhya (cognitive enhancement). For quality control and scientific validation, standardization and phytochemical characterisation of such polyherbal ghrita formulations are crucial.

Objective: To evaluate the phytochemical profile of Pathadi Ghrita using HPLC Method.

Methods: Pathadi Ghrita was subjected to solvent extraction using water: methanol:acetonitrile followed by RP-HPLC-DAD analysis at 210 nm and 254 nm wavelengths. Chromatographic separation was performed on an ULTRASIL-AR (250 × 4.6 mm) column using water-acetonitrile gradient mobile phase. The chromatographic fingerprint and phytoconstituent distribution were analyzed.

Results: RP-HPLC chromatograms demonstrated 62 peaks at 210 nm and 59 peaks at 254 nm, indicating the presence of multiple phytoconstituents. Terpenoids constituted the major class (58–60%), followed by alkaloids (approximately 30%), glycosides (5–6%), flavonoids (0.3%), phenolic acids (0.25%) and phytosterols (0.18%). Piperine was identified as the predominant alkaloid.

Conclusion: RP-HPLC fingerprinting revealed a rich diversity of bioactive metabolites in Pathadi Ghrita, particularly lipid-soluble terpenoids and piperine. The findings support the therapeutic potential and provide a scientific basis for quality control and standardization of Pathadi Ghrita.

KEYWORDS: Pathadi Ghrita, RP-HPLC, Phytochemical profiling, Piperine, Terpenoids, Ayurvedic formulation.

INTRODUCTION

Ayurveda emphasizes the use of Medhya Rasayana formulations for enhancing intellect, memory, concentration and cognitive performance. Ghrita-based formulations are considered ideal carriers for delivering lipophilic phytoconstituents to the central nervous system because of their Yogavahi property and ability to cross biological membranes¹.

Pathadi Ghrita is a classical Ayurvedic formulation containing Patha (*Cissampelos pareira*), Vacha (*Acorus calamus*), Shigru (*Moringa oleifera*), Haritaki (*Terminalia chebula*), Shunthi (*Zingiber officinale*), Maricha (*Piper nigrum*), Pippali (*Piper longum*), Saindhav Lavana and Ghrita. These ingredients possess documented antioxidant, neuroprotective, anti-inflammatory and cognitive-enhancing activities²⁻⁶.

Modern analytical techniques such as RP-HPLC provide reliable tools for qualitative and quantitative assessment of phytoconstituents in herbal formulations. Chromatographic fingerprinting serves as an important quality-control parameter and helps establish reproducibility and authenticity of herbal medicines⁷.

Therefore, the present study was undertaken to develop an RP-HPLC fingerprint profile of Pathadi Ghrta and characterize its major phytochemical constituents.

MATERIALS AND METHODS

UL SOLUTIONS
UL SOLUTIONS INC.
3661 KINGS HIGHWAY EAST
FARMINGTON, CT 06030-3333
TEL: 860-895-8300 FAX: 860-895-8301
WWW.ULSOLUTIONS.COM

UL Solutions, 3661 Kings Highway East, Farmington, CT 06030-3333
Attention: UL Solutions Department, 3661 Kings Highway East, Farmington, CT 06030-3333
Tel: 860-895-8300 Fax: 860-895-8301
E-mail: ul@ulsolutions.com
Web: www.ulsolutions.com

Composites Inc. #7486611 PAN NA000303 and ISO/IEC 17025:2017

INSTRUMENTATION DETAILS

CHROMATOGRAPHY/SPECTROSCOPY CONDITIONS	DESCRIPTIONS/SPECIFICATIONS
HP/PLC/PLC/PLC column details	HP/PLC/PLC/PLC 4.6 mm ID
Mobile Phase/Fluent Composition(s)	Mobile Phase/Fluent Composition(s)
Temperature	Temperature
Wavelength Selected	Wavelength Selected
Flow rate	Flow rate
Injection Volume	Injection Volume
Other Instruments/Equipment/Accessories	Other Instruments/Equipment/Accessories

EXPERIMENTAL DETAILS, METHODOLOGY

Priority 1 and 10 of Polybutene Oxide were taken and described in 1 and 10 of composite the equipment number 17025:2017, 1 and 10 of composite

Fig.No.01:HPLC Report Of Pathadi Ghrita(Instrumentation Details & Methodology)

Sample Collection

Pathadi Ghrita was prepared according to classical Ayurvedic procedures, Ghrita was analysed in liquid form and submitted for chromatographic evaluation at UltraChrom Innovatives Pvt. Ltd., Wardha, Maharashtra.

Sample Preparation

Exactly 1 mL of Pathadi Ghrita was dissolved in 6 mL of acetonitrile:methanol:water (3:2:1 v/v). The sample was kept overnight in an airtight container and subsequently heated in a water bath at 55°C for 10 minutes. Ultrasonication was carried out for 10 minutes followed by filtration through a 0.45 µm nylon membrane filter. Twenty microliters of the filtrate were injected into the HPLC system.

Instrumentation

- Instrument: SHIMADZU Prominence UFLC HPLC-DAD
- Column: ULTRASIL-AR (250 × 4.6 mm)
- Mobile phase: Water–Acetonitrile
- Flow rate: 1.0 mL/min
- Detection wavelengths: 210 nm and 254 nm
- Injection volume: 20 µL
- Temperature: 31°C

ULTRACHROM INNOVATIVES PVT. LTD.		Dr. Pankaj M. Kharbhe, B. Pharm, M. Res, PhD (DSC)	
Head Office: 100/101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194, 195, 196, 197, 198, 199, 200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215, 216, 217, 218, 219, 220, 221, 222, 223, 224, 225, 226, 227, 228, 229, 230, 231, 232, 233, 234, 235, 236, 237, 238, 239, 240, 241, 242, 243, 244, 245, 246, 247, 248, 249, 250, 251, 252, 253, 254, 255, 256, 257, 258, 259, 260, 261, 262, 263, 264, 265, 266, 267, 268, 269, 270, 271, 272, 273, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 285, 286, 287, 288, 289, 290, 291, 292, 293, 294, 295, 296, 297, 298, 299, 300, 301, 302, 303, 304, 305, 306, 307, 308, 309, 310, 311, 312, 313, 314, 315, 316, 317, 318, 319, 320, 321, 322, 323, 324, 325, 326, 327, 328, 329, 330, 331, 332, 333, 334, 335, 336, 337, 338, 339, 340, 341, 342, 343, 344, 345, 346, 347, 348, 349, 350, 351, 352, 353, 354, 355, 356, 357, 358, 359, 360, 361, 362, 363, 364, 365, 366, 367, 368, 369, 370, 371, 372, 373, 374, 375, 376, 377, 378, 379, 380, 381, 382, 383, 384, 385, 386, 387, 388, 389, 390, 391, 392, 393, 394, 395, 396, 397, 398, 399, 400, 401, 402, 403, 404, 405, 406, 407, 408, 409, 410, 411, 412, 413, 414, 415, 416, 417, 418, 419, 420, 421, 422, 423, 424, 425, 426, 427, 428, 429, 430, 431, 432, 433, 434, 435, 436, 437, 438, 439, 440, 441, 442, 443, 444, 445, 446, 447, 448, 449, 450, 451, 452, 453, 454, 455, 456, 457, 458, 459, 460, 461, 462, 463, 464, 465, 466, 467, 468, 469, 470, 471, 472, 473, 474, 475, 476, 477, 478, 479, 480, 481, 482, 483, 484, 485, 486, 487, 488, 489, 490, 491, 492, 493, 494, 495, 496, 497, 498, 499, 500, 501, 502, 503, 504, 505, 506, 507, 508, 509, 510, 511, 512, 513, 514, 515, 516, 517, 518, 519, 520, 521, 522, 523, 524, 525, 526, 527, 528, 529, 530, 531, 532, 533, 534, 535, 536, 537, 538, 539, 540, 541, 542, 543, 544, 545, 546, 547, 548, 549, 550, 551, 552, 553, 554, 555, 556, 557, 558, 559, 560, 561, 562, 563, 564, 565, 566, 567, 568, 569, 570, 571, 572, 573, 574, 575, 576, 577, 578, 579, 580, 581, 582, 583, 584, 585, 586, 587, 588, 589, 590, 591, 592, 593, 594, 595, 596, 597, 598, 599, 600, 601, 602, 603, 604, 605, 606, 607, 608, 609, 610, 611, 612, 613, 614, 615, 616, 617, 618, 619, 620, 621, 622, 623, 624, 625, 626, 627, 628, 629, 630, 631, 632, 633, 634, 635, 636, 637, 638, 639, 640, 641, 642, 643, 644, 645, 646, 647, 648, 649, 650, 651, 652, 653, 654, 655, 656, 657, 658, 659, 660, 661, 662, 663, 664, 665, 666, 667, 668, 669, 670, 671, 672, 673, 674, 675, 676, 677, 678, 679, 680, 681, 682, 683, 684, 685, 686, 687, 688, 689, 690, 691, 692, 693, 694, 695, 696, 697, 698, 699, 700, 701, 702, 703, 704, 705, 706, 707, 708, 709, 710, 711, 712, 713, 714, 715, 716, 717, 718, 719, 720, 721, 722, 723, 724, 725, 726, 727, 728, 729, 730, 731, 732, 733, 734, 735, 736, 737, 738, 739, 740, 741, 742, 743, 744, 745, 746, 747, 748, 749, 750, 751, 752, 753, 754, 755, 756, 757, 758, 759, 760, 761, 762, 763, 764, 765, 766, 767, 768, 769, 770, 771, 772, 773, 774, 775, 776, 777, 778, 779, 780, 781, 782, 783, 784, 785, 786, 787, 788, 789, 790, 791, 792, 793, 794, 795, 796, 797, 798, 799, 800, 801, 802, 803, 804, 805, 806, 807, 808, 809, 810, 811, 812, 813, 814, 815, 816, 817, 818, 819, 820, 821, 822, 823, 824, 825, 826, 827, 828, 829, 830, 831, 832, 833, 834, 835, 836, 837, 838, 839, 840, 841, 842, 843, 844, 845, 846, 847, 848, 849, 850, 851, 852, 853, 854, 855, 856, 857, 858, 859, 860, 861, 862, 863, 864, 865, 866, 867, 868, 869, 870, 871, 872, 873, 874, 875, 876, 877, 878, 879, 880, 881, 882, 883, 884, 885, 886, 887, 888, 889, 890, 891, 892, 893, 894, 895, 896, 897, 898, 899, 900, 901, 902, 903, 904, 905, 906, 907, 908, 909, 910, 911, 912, 913, 914, 915, 916, 917, 918, 919, 920, 921, 922, 923, 924, 925, 926, 927, 928, 929, 930, 931, 932, 933, 934, 935, 936, 937, 938, 939, 940, 941, 942, 943, 944, 945, 946, 947, 948, 949, 950, 951, 952, 953, 954, 955, 956, 957, 958, 959, 960, 961, 962, 963, 964, 965, 966, 967, 968, 969, 970, 971, 972, 973, 974, 975, 976, 977, 978, 979, 980, 981, 982, 983, 984, 985, 986, 987, 988, 989, 990, 991, 992, 993, 994, 995, 996, 997, 998, 999, 1000, 1001, 1002, 1003, 1004, 1005, 1006, 1007, 1008, 1009, 1010, 1011, 1012, 1013, 1014, 1015, 1016, 1017, 1018, 1019, 1020, 1021, 1022, 1023, 1024, 1025, 1026, 1027, 1028, 1029, 1030, 1031, 1032, 1033, 1034, 1035, 1036, 1037, 1038, 1039, 1040, 1041, 1042, 1043, 1044, 1045, 1046, 1047, 1048, 1049, 1050, 1051, 1052, 1053, 1054, 1055, 1056, 1057, 1058, 1059, 1060, 1061, 1062, 1063, 1064, 1065, 1066, 1067, 1068, 1069, 1070, 1071, 1072, 1073, 1074, 1075, 1076, 1077, 1078, 1079, 1080, 1081, 1082, 1083, 1084, 1085, 1086, 1087, 1088, 1089, 1090, 1091, 1092, 1093, 1094, 1095, 1096, 1097, 1098, 1099, 1100, 1101, 1102, 1103, 1104, 1105, 1106, 1107, 1108, 1109, 1110, 1111, 1112, 1113, 1114, 1115, 1116, 1117, 1118, 1119, 1120, 1121, 1122, 1123, 1124, 1125, 1126, 1127, 1128, 1129, 1130, 1131, 1132, 1133, 1134, 1135, 1136, 1137, 1138, 1139, 1140, 1141, 1142, 1143, 1144, 1145, 1146, 1147, 1148, 1149, 1150, 1151, 1152, 1153, 1154, 1155, 1156, 1157, 1158, 1159, 1160, 1161, 1162, 1163, 1164, 1165, 1166, 1167, 1168, 1169, 1170, 1171, 1172, 1173, 1174, 1175, 1176, 1177, 1178, 1179, 1180, 1181, 1182, 1183, 1184, 1185, 1186, 1187, 1188, 1189, 1190, 1191, 1192, 1193, 1194, 1195, 1196, 1197, 1198, 1199, 1200, 1201, 1202, 1203, 1204, 1205, 1206, 1207, 1208, 1209, 1210, 1211, 1212, 1213, 1214, 1215, 1216, 1217, 1218, 1219, 1220, 1221, 1222, 1223, 1224, 1225, 1226, 1227, 1228, 1229, 1230, 1231, 1232, 1233, 1234, 1235, 1236, 1237, 1238, 1239, 1240, 1241, 1242, 1243, 1244, 1245, 1246, 1247, 1248, 1249, 1250, 1251, 1252, 1253, 1254, 1255, 1256, 1257, 1258, 1259, 1260, 1261, 1262, 1263, 1264, 1265, 1266, 1267, 1268, 1269, 1270, 1271, 1272, 1273, 1274, 1275, 1276, 1277, 1278, 1279, 1280, 1281, 1282, 1283, 1284, 1285, 1286, 1287, 1288, 1289, 1290, 1291, 1292, 1293, 1294, 1295, 1296, 1297, 1298, 1299, 1300, 1301, 1302, 1303, 1304, 1305, 1306, 1307, 1308, 1309, 1310, 1311, 1312, 1313, 1314, 1315, 1316, 1317, 1318, 1319, 1320, 1321, 1322, 1323, 1324, 1325, 1326, 1327, 1328, 1329, 1330, 1331, 1332, 1333, 1334, 1335, 1336, 1337, 1338, 1339, 1340, 1341, 1342, 1343, 1344, 1345, 1346, 1347, 1348, 1349, 1350, 1351, 1352, 1353, 1354, 1355, 1356, 1357, 1358, 1359, 1360, 1361, 1362, 1363, 1364, 1365, 1366, 1367, 1368, 1369, 1370, 1371, 1372, 1373, 1374, 1375, 1376, 1377, 1378, 1379, 1380, 1381, 1382, 1383, 1384, 1385, 1386, 1387, 1388, 1389, 1390, 1391, 1392, 1393, 1394, 1395, 1396, 1397, 1398, 1399, 1400, 1401, 1402, 1403, 1404, 1405, 1406, 1407, 1408, 1409, 1410, 1411, 1412, 1413, 1414, 1415, 1416, 1417, 1418, 1419, 1420, 1421, 1422, 1423, 1424, 1425, 1426, 1427, 1428, 1429, 1430, 1431, 1432, 1433, 1434, 1435, 1436, 1437, 1438, 1439, 1440, 1441, 1442, 1443, 1444, 1445, 1446, 1447, 1448, 1449, 1450, 1451, 1452, 1453, 1454, 1455, 1456, 1457, 1458, 1459, 1460, 1461, 1462, 1463, 1464, 1465, 1466, 1467, 1468, 1469, 1470, 1471, 1472, 1473, 1474, 1475, 1476, 1477, 1478, 1479, 1480, 1481, 1482, 1483, 1484, 1485, 1486, 1487, 1488, 1489, 1490, 1491, 1492, 1493, 1494, 1495, 1496, 1497, 1498, 1499, 1500, 1501, 1502, 1503, 1504, 1505, 1506, 1507, 1508, 1509, 1510, 1511, 1512, 1513, 1514, 1515, 1516, 1517, 1518, 1519, 1520, 1521, 1522, 1523, 1524, 1525, 1526, 1527, 1528, 1529, 1530, 1531, 1532, 1533, 1534, 1535, 1536, 1537, 1538, 1539, 1540, 1541, 1542, 1543, 1544, 1545, 1546, 1547, 1548, 1549, 1550, 1551, 1552, 1553, 1554, 1555, 1556, 1557, 1558, 1559, 1560, 1561, 1562, 1563, 1564, 1565, 1566, 1567, 1568, 1569, 1570, 1571, 1572, 1573, 1574, 1575, 1576, 1577, 1578, 1579, 1580, 1581, 1582, 1583, 1584, 1585, 1586, 1587, 1588, 1589, 1590, 1591, 1592, 1593, 1594, 1595, 1596, 1597, 1598, 1599, 1600, 1601, 1602, 1603, 1604, 1605, 1606, 1607, 1608, 1609, 1610, 1611, 1612, 1613, 1614, 1615, 1616, 1617, 1618, 1619, 1620, 1621, 1622, 1623, 1624, 1625, 1626, 1627, 1628, 1629, 1630, 1631, 1632, 1633, 1634, 1635, 1636, 1637, 1638, 1639, 1640, 1641, 1642, 1643, 1644, 1645, 1646, 1647, 1648, 1649, 1650, 1651, 1652, 1653, 1654, 1655, 1656, 1657, 1658, 1659, 1660, 1661, 1662, 1663, 1664, 1665, 1666, 1667, 1668, 1669, 1670, 1671, 1672, 1673, 1674, 1675, 1676, 1677, 1678, 1679, 1680, 1681, 1682, 1683, 1684, 1685, 1686, 1687, 1688, 1689, 1690, 1691, 1692, 1693, 1694, 1695, 1696, 1697, 1698, 1699, 1700, 1701, 1702, 1703, 1704, 1705, 1706, 1707, 1708, 1709, 1710, 1711, 1712, 1713, 1714, 1715, 1716, 1717, 1718, 1719, 1720, 1721, 1722, 1723, 1724, 1725, 1726, 1727, 1728, 1729, 1730, 1731, 1732, 1733, 1734, 1735, 1736, 1737, 1738, 1739, 1740, 1741, 1742, 1743, 1744, 1745, 1746, 1747, 1748, 1749, 1750, 1751, 1752, 1753, 1754, 1755, 1756, 1757, 1758, 1759, 1760, 1761, 1762, 1763, 1764, 1765, 1766, 1767, 1768, 1769, 1770, 1771, 1772, 1773, 1774, 1775, 1776, 1777, 1778, 1779, 1780, 1781, 1782, 1783, 1784, 1785, 1786, 1787, 1788, 1789, 1790, 1791, 1792, 1793, 1794, 1795, 1796, 1797, 1798, 1799, 1800, 1801, 1802, 1803, 1804, 1805, 1806, 1807, 1808, 1809, 1810, 1811, 1812, 1813, 1814, 1815, 1816, 1817, 1818, 1819, 1820, 1821, 1822, 1823, 1824, 1825, 1826, 1827, 1828, 1829, 1830, 1831, 1832, 1833, 1834, 1835, 1836, 1837, 1838, 1839, 1840, 1841, 1842, 1843, 1844, 1845, 1846, 1847, 1848, 1849, 1850, 1851, 1852, 1853, 1854, 1855, 1856, 1857, 1858, 1859, 1860, 1861, 1862, 1863, 1864, 1865, 1866, 1867, 1868, 1869, 1870, 1871, 1872, 1873, 1874, 1875, 1876, 1877, 1878, 1879, 1880, 1881, 1882, 1883, 1884, 1885, 1886, 1887, 1888, 1889, 1890, 1891, 1892, 1893, 1894, 1895, 1896, 1897, 1898, 1899, 1900, 1901, 1902, 1903, 1904, 1905, 1906, 1907, 1908, 1909, 1910, 1911, 1912, 1913, 1914, 1915, 1916, 1917, 1918, 1919, 1920, 1921, 1922, 1923, 1924, 1925, 1926, 1927, 1928, 1929, 1930, 1931, 1932, 1933, 1934, 1935, 1936, 1937, 1938, 1939, 1940, 1941, 1942, 1943, 1944, 1945, 1946, 1947, 1948, 1949, 1950, 1951, 1952, 1953, 1954, 1955, 1956, 1957, 1958, 1959, 1960, 1961, 1962, 1963, 1964, 1965, 1966, 1967, 1968, 1969, 1970, 1971, 1972, 1973, 1974, 1975, 1976, 1977, 1978, 1979, 1980, 1981, 1982, 1983, 1984, 1985, 1986, 1987, 1988, 1989, 1990, 1991, 1992, 1993, 1994, 1995, 1996, 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023, 2024, 2025, 2026, 2027, 2028, 2029, 2030, 2031, 2032, 2033, 2034, 2035, 2036, 2037, 2038, 2039, 2040, 2041, 2042, 2043, 2044, 2045, 2046, 2047, 2048, 2049, 2050, 2051, 2052, 2053, 2054, 2055, 2056, 2057, 2058, 2059, 2060, 2061, 2062, 2063, 2064, 2065, 2066, 2067, 2068, 2069, 2070, 2071, 2072, 2073, 2074, 2075, 2076, 2077, 2078, 2079, 2080, 2081, 2082, 2083, 2084, 2085, 2086, 2087, 2088, 2089, 2090, 2091, 2092, 2093, 2094, 2095, 2096, 2097, 2098, 2099, 2100, 2101, 2102, 2103, 2104, 2105, 2106, 2107, 2108, 2109, 2110, 2111, 2112, 2113, 2114, 2115, 2116, 2117, 2118, 2119, 2120, 2121, 2122, 2123, 2124, 2125, 2126, 2127, 2128, 2129, 2130, 2131, 2132, 2133, 2134, 2135, 2136, 2137, 2138, 2139, 2140, 2141, 2142, 2143, 2144, 2145, 2146, 2147, 2148, 2149, 2150, 2151, 2152, 2153, 2154, 2155, 2156, 2157, 2158, 2159, 2160, 2161, 2162, 2163, 2164, 2165, 2166, 2167, 2168, 2169, 2170, 2171, 2172, 2173, 2174, 2175, 2176, 2177, 2178, 2179, 2180, 2181, 2182, 2183, 2184, 2185, 2186, 2187, 2188, 2189, 2190, 2191, 2192, 2193, 2194, 2195, 2196, 2197, 2198, 2199, 2200, 2201, 2202, 2203, 2204, 2205, 2206, 2207, 2208, 2209, 2210, 2211, 2212, 2213, 2214, 2215, 2216, 221			

- 59 detectable peaks at 254 nm

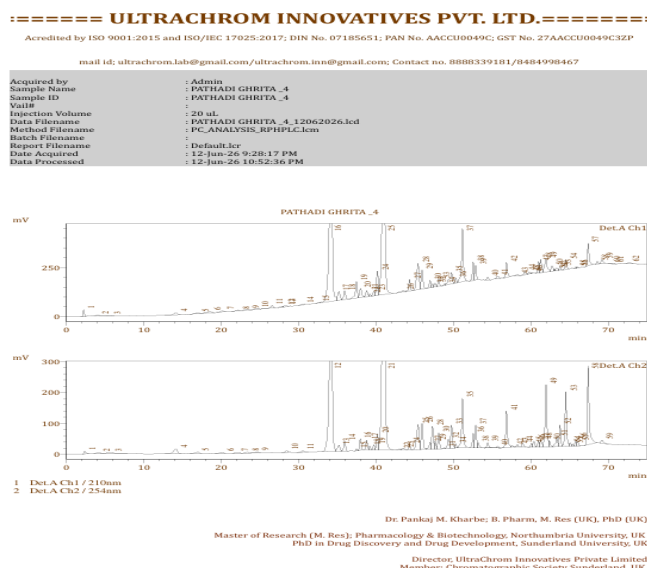


Fig.No.04:HPLC Report Of Pathadi Ghrita(Wide Range Of Phytoconstituents)

indicating the presence of a wide range of phytoconstituents.

Table No.01: Phytoconstituents Of Pathadi Ghrita

S.NO.	Phytochemical Class	Contribution (%)	Components
1.	Phenolic acids	0.25	5
2.	Alkaloids	30	3
3.	Flavonoids	0.30	4
4.	Glycosides	5–6	6
5.	Terpenoids	58–60	40
6.	Phytosterols	0.18	2

Major Peaks

The chromatogram exhibited two dominant peaks around retention times 34 – 41 minutes, contributing approximately 30.94% and 29.02% of the total area respectively, indicating the abundance of major bioactive constituents.

Identified Marker Compounds

The study identified:

- Gallic acid
- Vanillic acid
- Piperine
- β -Sitosterol

among the detectable phytochemical constituents. Piperine represented the predominant alkaloidal constituent.

DISCUSSION

The RP-HPLC profile revealed that Pathadi Ghrita is predominantly composed of lipophilic phytoconstituents. This observation is expected because ghrita selectively extracts and retains lipid-soluble metabolites during the pharmaceutical processing of herbal drugs.

The low proportion of phenolic acids and flavonoids observed in the chromatogram may be attributed to their polar nature and limited partitioning into the lipid matrix of ghrita. Similar findings have been reported in studies evaluating medicated ghee formulations where hydrophilic constituents are present in relatively lower concentrations⁸.

Piperine, detected as the major alkaloid, is well known for its bioavailability-enhancing, antioxidant, anti-inflammatory and neuroprotective properties. It enhances absorption of phytochemicals and may contribute significantly to the Medhya action of Pathadi Ghrita⁹.

Terpenoids represented the largest phytochemical group (58–60%). Terpenoids derived from *Acorus calamus*, *Zingiber officinale*, *Piper longum* and *Moringa oleifera* have demonstrated antioxidant, anti-inflammatory and cognitive-enhancing activities in experimental studies^{10–12}.

The presence of phytosterols, glycosides, phenolic acids and flavonoids further contributes to the pharmacological diversity of the formulation. These compounds collectively provide antioxidant and neuroprotective effects that may support cognitive functions and neuronal health¹³.

REFERENCES

1. Sharma RK, Dash B. Charaka Samhita. Vol. 1. Varanasi: Chowkhamba Sanskrit Series Office; 2014.
2. Kirtikar KR, Basu BD. Indian Medicinal Plants. 2nd ed. Dehradun: International Book Distributors; 2006.
3. Nadkarni AK. Indian Materia Medica. Mumbai: Popular Prakashan; 2015.
4. Warriar PK. Indian Medicinal Plants: A Compendium of 500 Species. Chennai: Orient Longman; 2005.
5. Singh RH. Exploring larger evidence-base for contemporary Ayurveda. *Int J Ayurveda Res.* 2010;1(2):65–66.
6. Sharma PV. Dravyaguna Vijnana. Vol. II. Varanasi: Chaukhambha Bharati Academy; 2013.
7. Mukherjee PK. Quality Control and Evaluation of Herbal Drugs. New Delhi: Elsevier; 2019.
8. Galib R, Patgiri BJ, Prajapati PK. Pharmaceutical standardization of Ayurvedic ghrita preparations. *AYU.* 2011;32(3):402-406.
9. Srinivasan K. Black pepper and its pungent principle piperine: A review. *Crit Rev Food Sci Nutr.* 2007;47(8):735-748.
10. Dhingra D, Kumar V. Memory-enhancing activity of *Acorus calamus*. *J Ethnopharmacol.* 2006;106(3):321-327.
11. Ali BH, Blunden G, Tanira MO, Nemmar A. Some phytochemical, pharmacological and toxicological properties of ginger. *Food Chem Toxicol.* 2008;46(2):409-420.
12. Fahey JW. *Moringa oleifera*: A review of medicinal evidence. *Trees Life J.* 2005;1:5.
13. Sultana B, Anwar F, Ashraf M. Effect of extraction solvent on antioxidant activity of medicinal plants. *Molecules.* 2009;14(6):2167-2180.