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AN UPDATED REVIEW ON ANALYTICAL METHODS FOR THE AZELNIDIPINE AND TELMISARTAN IN PHARMACEUTICAL DOSAGE FORM

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ABSTRACT: Hypertension, also known as high blood pressure, occurs when the force of blood against the artery walls is excessively high the force of blood against the artery wall is too high. Hypertension is a very common disorder, particularly in past middle age. For improvement activity of hypertension, Azelnidipine and Telmisartan are newer combination in the market which is effective in hypertension. This combination was developed to improve medication for stage II hypertension. Azelnidipine is a Calcium channel blocker, and Telmisartan is an Angiotensin II receptor blocker. This review provides information about different analytical methods for estimating Azelnidipine and Telmisartan individually or in combination with other drugs, such as UV spectrophotometry, HPTLC, HPLC, and LC-MS. All reported methods were found to be simple, accurate, economical, precise, and reproducible. This review focuses on the recent analytical method development of Azelnidipine and Telmisartan in their combined dosage form. It also includes a stability-indicating analytical method for determining Azelnidipine and Telmisartan.

INTRODUCTION: Azelnidipine is a dihydropyridine calcium channel blocker. Azelnidipine is L and T calcium channel blocker. It is sold in Japan by Daiichi-Sankyo Pharmaceuticals, Inc. Unlike nicardipine; it has a gradual onset and a long-lasting hypoglycaemic effect, with little increase in heart rate. The Drug Controller General of India (DCGI) has approved the use of Azelnipine in India. It was launched under the Azusa (Ajanta Pharma Ltd.) brand in 2020 [1].

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Mechanism of Action of Azelnidipine: Azelnidipine inhibits trans-membrane Calcium influx through the voltage-dependent channels of smooth muscles in vascular walls. Calcium channels are classified into various categories, including L-type, T-type, N-type, P/Q-type, and R-type Calcium channels. Normally, calcium induces smooth muscle contraction, contributing to hypertension. When calcium channels are blocked, the vascular smooth muscle does not contract, resulting in the relaxation of vascular smooth muscle walls and decreased blood pressure [2].

Telmisartan: Telmisartan, sold under the brand name Micardis among others, is a medication that is widely prescribed for the treatment of high blood pressure, heart failure, and diabetic kidney disease. It is considered to be a reasonable initial treatment option for individuals with high blood pressure, and

it is typically administered orally. In addition to the standalone form, Telmisartan is available in combination with hydrochlorothiazide, cilnidipine, and amlodipine. It is worth noting that Telmisartan stands out from other drugs in its class due to its relatively high average dosage of 80 mg/day.

Mechanism of Action of Telmisartan: Telmisartan is an angiotensin II receptor blocker (ARB). It works by blocking a substance in the body that causes blood vessels to tighten. As a result, telmisartan relaxes the blood vessels. This lowers blood pressure and increases the supply of blood and oxygen to the heart [4].

Physical and Chemical Property: Azelnidipine is light yellow to yellow crystalline powder. IUPAC name is 3-[1- (Benzyldrylazetidin-3-yl] 5-isopropyl- 2- amino6methyl-4-(3-nitrophenyl)-1,4-dihydropyridine-3, 5dicarboxylate. The molecular formula of Azelnidipine is $C_{33}H_{34}N_4O_6$. Molecular weight is 582.646 g/mol. It is insoluble in water, slightly soluble in methanol, soluble in ethyl acetate, freely soluble in acetone, and in acetic acid [5].

Telmisartan is white to off-white crystalline powder. IUPAC name is 2-(4-[[4-methyl-6-(1-methylbenzimidazol-2yl)-2 –propylbenzimidazol-1yl] methyl] biphenyl)-benzoic acid. Molecular formula of Telmisartan $C_{33}H_{30}N_4O_2$. Molecular weight is 514.6 g/mol It is insoluble in water, sparingly soluble in dichloromethane, strong acid, and organic solvents and soluble in strong base and methanol [6].

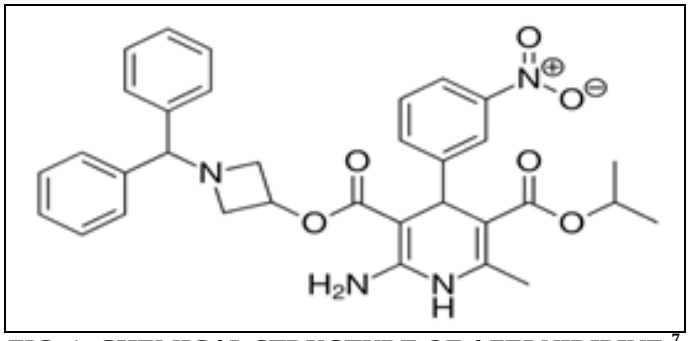

FIG. 1: CHEMICAL STRUCTURE OF AZELNIDIPINE [7]

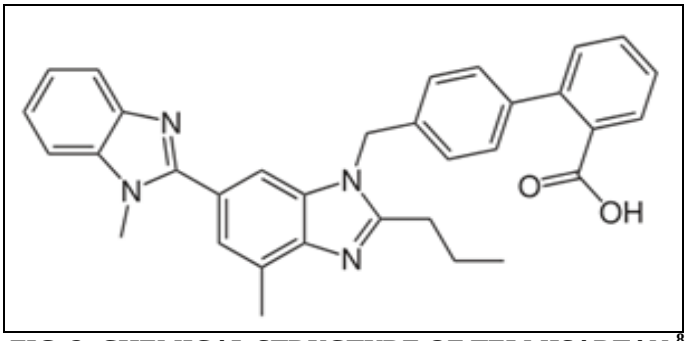

FIG. 2: CHEMICAL STRUCTURE OF TELMISARTAN [8]

TABLE 1: OFFICIAL METHOD FOR ASSESSMENT OF AZELNIDIPINE

Sr. no.	Official In	Method	Description
1.	Indian Pharmacopoeia (2018) [9]	Liquid Chromatography	**Column:** Octadecylsilane Silica (25cm x 4.6 mm,5µ **Mobile phase:** 0.03 M potassium dihydrogen orthophosphate in water: Acetonitrile (50:50) v/v **Wavelength:** 256 nm **Flow rate:** 1.0 ml/min Injection volume :20 µL

TABLE 2: REPORTED METHODS FOR ASSESSMENT OF AZELNIDIPINE

Sr. no.	Title/Method	Description
1.	Validated Stability-Indicating RP-HPLC Method for the Simultaneous Determination of Azelnidipine and Olmesartan in their Combined Dosage Form[10].	**Column**: Hypersil GOLD C18 (150 mm × 4.6mm, 5 µm) **Mobile Phase**: Methanol: Acetonitrile: Water (40:40:20) v/v/v **Flow rate**: 0.5 mL/min **Wavelength** :260 nm **Linearity**: AZL – 2 - 48 µg/ml OLM- 2.5 - 60 µg/ml **Retention Time**: AZL -8.56min. OLM - 3.04 min
2.	UV Spectrophotometric method development and Validation for Determination of Azelnidipine in Pharmaceutical Dosage Form[11].	**Model**: Shimadzu 1800 UV Visible spectrophotometer **Solvent**: Methanol **Wavelength (nm)**: 255nm **Linearity**: 2 - 14 µg/ ml
3.	Validation and Forced Stability- Indicating HPTLC Method For Determination of Azelnidipine[12].	**Stationary Phase**: Silica gel 60 F254 (20cm × 10cm, 0.2mm) **Mobile Phase**: Chloroform: Ethyl acetate: methanol 6.5:3.5: 0.1 (v/v/v) **Wavelength**: 255nm **Linearity**: 300-800ng/band

		Rf Value: 0.59,0.60
4.	Simultaneous Determination of Azelnidipine and Olmesartan medoxomil by First Derivative Spectrophotometric Method[13].	**Model**: Shimadzu – 1800 UV Visible Spectrophotometer **Solvent**: Methanol **Method**: **1. First Derivative Spectrophotometric method** **Wavelength (nm):** AZL - 217nm OLM- 239.4 nm **Linearity**: 4 - 32 µg/ ml
5.	Spectrophotometric estimation of Azelnidipine in Bulk and Pharmaceutical dosage form by second order derivative methods[14].	**Model**: Shimadzu 1800 UV Visible Spectrophotometer **Solvent**: Methanol **Method: 1. Second Derivative Spectrophotometric method** **Wavelength**: 233.8 nm **Linearity**: 1 - 20 µg / ml
6.	Method Development and Validation of Azelnidipine by RP-HPLC[15].	**Column**: C18 column (250 mm x 4.5 mm, 5 µm) **Mobile Phase**: Methanol: Water (75:25) v/v,0.1%glacial acetic acid. **Flow rate**: 1 mL/min **Wavelength**: 254nm **Linearity**: 10 - 50 µg/ml **Retention Time**: 6.13 min.
7.	RP-HPLC Method Development and Validation of Azelnidipine[16].	**Column**: C18 column (250 mm x 4.5 mm, 5µm) **Mobile Phase**: Methanol: Water (80:20) v/v, Orthophosphoric acid (pH-3) **Flow rate**:1 mL/min. **Wavelength**:257 nm **Linearity**:20-100µg/ml **Retention Time**: 6.5 min.
8.	Sensitive Analysis of Azelnidipine and Related Derivative in Human Plasma by Ultra-Performance Liquid Chromatography-Tandam Mass Spectrometry[17].	**Column**: C18 (50 mm × 2.1 mm.,1.7 µm) **Mobile Phase**: A (20 mm Ammonium acetate aqueous solution) B (0.1 % formic acid in Acetonitrile) **Flow Rate**: 0.5 mL/min **Linearity**: 0.01-10 mg/ml **Retention Time:** AZL -1.38 min. IS -1.26 min.
9.	Simultaneous determination of Azelnidipine and two metabolites in Human Plasma using Liquid chromatography-tandem mass spectrometry[18].	**Column**: Intersil ODS-3 C18 (2.1 mm × 150 mm,5µm) **Mobile Phase**: Methanol: Water: Acetic Acid (800:200:0.2) v/v **Flow rate**: 0.2ml/min. **Wavelength**: 256nm **Linearity**: 0.5-40 mg/ml **Retention Time**: AZL –3.6min. M-1(Aeromatized form)-10.2min. M-2(Hydroxylated Form)-6.8min.
10.	Stability Indicating Analytical Method Development and Validation for Estimation of Azelnidipine[19].	**UV Spectrophotometric method: Solvent**: Methanol: Water (80:20) v/v **Method 1- Zero order Spectrophotometric method** **Method 2 -First order Derivative Spectrophotometric method Wavelength**: Method 1 -257 nm Method 2- 242.6 nm **Linearity**: 2-10µg/ml **Method 3 – RP HPLC Method** **Column**: ODS C18 (250mm×4.6mm.,5µm) **Mobile phase**: Sodium dibasic Phosphate Buffer: Acetonitrile: Methanol (10:50:40) v/v/v, orthophosphoric acid (pH - 4.5) **Flow rate**: 1mL/min, **Wavelength**: Method 3 -256nm, **Linearity**: 2-12µg/m l **Retention Time**: 6.1 min.
11.	Simultaneous Determination of Azelnidipine and Olmesartan Medoxomil in Pharmaceutical Dosage Forms by UFLC Method[20].	**Column:** ODS (250mm x 4.6mm, 5µm) **Mobile Phase**: Methanol: Water (85:15) v/v **Flow Rate**: 1.5ml/min. **Wavelength**: 255nm **Linearity**: 2-16 mg/ml

		Retention Time: AZL - 6.80 min. OLM -1.72 min.
12.	Analytical method development and Validation of Azelnidipine by UV-visible spectroscopy[21].	Double Beam UV- visible spectrophotometer with 1.0cm matching quartz **Wavelength**: 200-400 nm **Solvent**: Distilled grade water Methanol
13.	Development and Validation of RP-HPLC method for quantification of Azelnidipine in tablet[22].	**Column**: Luna C18 (150 x 4.6mm, 5µm) **Mobile phase**: Acetonitrile: Water (90:10) **Flowrate**: 1ml/min **Wavelength**: 255nm **Injection volume**: 20µl **Retention time**- 3.5 min **Run time**- 10 min
14.	Development and Validation of Stability Indicating RP-HPLC Method for Azelnidipine for bulk drug[23].	**Column**: Phenomenex Hyper Clone C18 column (250 × 4.6 mm, 5µm) **Mobilephase**: methanol: water 75:25% v/v **Flow rate**: 1ml/min **Wavelength**: 256nm **Retention time**- 3.5 min **Run time**- 10 min
15.	Stability-Indicating LC Method for Quantification of Azelnidipine: Synthesis and Characterization of Oxidative Degradation Product[24].	**Mobile phase**: phosphate buffer (pH 3.0) methanol 10:90% v/v **Flow rate:** 1.0 mL/min **Wavelength**: 256 nm
16.	Mathematically Processed UV Spectroscopic Method for Quantification of Chlorthalidone and Azelnidipine in Bulk and Formulation[25].	**Model:** UV spectrophotometer (1650, Shimadzu, Japan) **Wavelength**: 238.5 nm and 239.5 nm for CTL and 272.1 nm and 342.1 nm for AZE, respectively **Solvent**: Absolute ethyl alcohol (ethanol)
17	Special Emphasis on Bio-analytical Method development and Validation of an Anti-Hypertensive Drug Azelnidipine by LC-ESI-MS/MS in Healthy Human Volunteer's Blood Plasma[26].	**Column**: C18 Phenomenex Kinetex (50x3mm, 5µ) **Mobilephase**: 0.1% Formic Acid in Acetonitrile and Milli-Q water with 10mM Ammonium acetate **Flow rate**: 0.5 ml/min **Retention time**- 3.5 min **Injection Volume**- 10 µl **Run time**- 7 min

TABLE 3: OFFICIAL METHOD FOR ASSESSMENT OF TELMISARTAN

Sr. no.	Official In	Method	Description
1.	Indian Pharmacopoeia (2018)[27]	Liquid Chromatography	**Stationary Phase:** A stainless steel Column 12.5 cm×4mm, packed with octadecylsilane bonded to porous silica (5 µm) **Mobile Phase**: A) Dissolve 2.0 g of Potassium Dihydrogen Phosphate and 3.8g of Sodium Pentane sulphonate monohydrate in water, adjust to pH 3 with orthophosphoric acid dilute to 1000ml with water. B) A Mixture of 20 Volume of Methanol and 80 Volume of Acetonitrile. (20 :80) v/v **Flow rate**: 1ml/min. **Wavelength**: 230nm **Injection Volume**: 10µL

TABLE 4: REPORTED METHODS FOR ASSESSMENT OF TELMISARTAN

Sr. no.	Title/Method	Description
1.	RP-HPLC Method Development and Validation for estimation of Telmisartan in bulk and tablet dosage form[28].	**Column**: RP18, column (250×4.6mm) **Mobile phase**: 0.025M potassium dihydrogenphosphate: acetonitrile: methanol (45:50:5) **Flow rate**: 1ml/min **Wavelength**: 216 nm
2.	Method development and validation of Telmisartan in bulk and pharmaceutical	**Model**: Shimadzu, model 1700 **Wavelength**: 298nm

	dosage forms by UV spectrophotometric method[29].	**Solvent**: Methanol: Water (90: 10)
3.	UV-spectrophotometric analytical method development and Validation for determination of Telmisartan in pharmaceutical drug and drug product[30].	**Model**: U.V. visible double beam spectrophotometers SL210 Elico **Wavelength**: 200-400 nm **Solvent**:Water and Methanol
4.	Stability Indicating assay of Telmisartan in tablets[31].	**Column**: Kromasil C18 (4.6 × 150 mm, 5 µm) **Mobile phase**: 0.01 M Phosphate buffer (pH: 3) and Acetonitrile in ratio of (40:60%) **Flow rate**: 2ml/min **Wavelength**: 226 nm **Retention time**- 2.728 min
5.	Stress degradation studies on Telmisartan and development of a validated method by UV spectrophotometry in bulk and pharmaceutical dosage forms[32].	**Model**: A double beam UV-Visible spectrophotometer (Shimadzu-1800) with UV probe 2.31 software **Wavelength**:200–380nm **Solvent:** Methanol
6.	Determination of Telmisartan by HPTLC – A Stability Indicating Assay[33].	**Mobile phase**: chloroform–methanol 8.6:1.4 (v/v) containing 0.1% ammonia **HPTLC plate**: 10 cm × 20 cm aluminum-backed **Wavelength**: 297 nm **Scanning speed**: 5 mm s–1 **Source of radiation**: deuterium lamp
7.	Stability Indicating HPLC method for the determination of Telmisartanas bulk drug and in pharmaceutical dosage form[34].	**Model**: M/S Shimadzu HPLC system with a photodiode array detector system (SPD – M20A) **Column**: Phenomenex luna ODS, (25 cm x 4.6 mm OD, 5µ, pore size 100A°) **Mobile phase**: phosphate buffer and acetonitrile 60: 40 **Flow rate**: 1.5ml/min **Wavelength**: 230 nm **Retention time**: 2.728 min **Run time**: 30 minutes
8.	Stability-Indicating RP-HPLC Method for Analysis of Telmisartanin the Bulk Drug and in Formulations[35].	**Model**: Jasco model PU 1580, intelligent HPLC pump, an AS-1555 sampler with auto injecting facility **Column**: C18 column **Mobile phase**: Methanol: Water 80:20 (v/v) **Flow rate**: 1.0ml/min **Wavelength**: 225 nm **Retention time**: 4.85 ± 0.05 min
9.	Stability Indicating HPTLC method for simultaneous determination of Telmisartan and Ramipril in tablets[36].	**HPTLC plates**: (Merck) precoated with silica gel 60F254 aluminium sheets **Mobile phase**: toluene: acetonitrile: formic acid: water (5:5:0.3:1) **Wavelength**: 212 nm
10.	Development and Validation of Stability Indicating HPTLC and HPLC Methods for Simultaneous Determination of Telmisartan and Atorvastatin in their Formulations[37].	For RP-HPLC: **Column**: Phenomenex Luna C_{18} **Mobile phase**: acetonitrile: 0.025 M ammonium acetate (38: 52%, v/v) **Flow rate**: 1.0ml/min **Wavelength**: 281 nm For HPTLC: **HPTLC plates**: Silica gel 60 F_{254} **Mobile phase**: toluene-methanol-ethyl acetate-acetic acid (5: 1: 1: 0.3, v/v) **Wavelength**: 279 nm
11.	A validated stability indicating HPTLC method for simultaneous estimation of Ramipril and Telmisartan[38].	**HPTLC plates**: TLC plate precoated with Silica gel 60 F254 **Mobile phase**: Methanol: Chloroform (1:6) v/v **Wavelength**: 210 nm
12.	Development and Validation of stability-indicating HPTLC method for simultaneous determination of Telmisartan and Cilnidipine in combined tablet dosage	**HPTLC plates**: Precoated silica gel aluminium plate 60 F254(10 ×10) with 250µm thickness **Mobile phase**: Toluene: Methanol: Glacial acetic acid (8: 2: 1, v/v/v)

	form[39].	**Wavelength**: 260 nm **Retention factor**: Telmisartan 0.38 ± 0.004 and cilnidipine 0.62 ± 0.007
13.	Stability-Indicating RP-HPLC method development and Validation for simultaneous estimation of Telmisartan and Rosuvastatin calcium in bulk and in tablet dosage form[40].	**Column**: Oyster ODS3 (150 × 4.6 mm,5 µm) **Mobile phase**: phosphate buffer with 1.1 g octane-1-sulfonic acid sodium salt having pH 2.5 and acetonitrile, with a proportion of 500:500, v/v **Flow rate**: 1.0 mL/min
14.	Stability-Indicating HPLC method for simultaneous estimation of low-level impurities of Telmisartan and Hydrochlorothiazide in tablet dosage forms[41].	**Column**: Inertsil ODS 3V (250 x 4.6 mm, 5µm) **Flow rate**: 1.3 mL/min **Wavelength**: 260 nm **Buffer**: 1 % (v/v) triethylamine in potassium hydrogen orthophosphate (pH 2.5) and acetonitrile buffer
15.	Stability indicating reverse-phase high-performance liquid chromatography method development and Validation for simultaneous estimation of Telmisartan and Benidipine hydrochloride in pharmaceutical dosage form[42].	**Column**: C18, 250×4.6 mm column of 5.0µm particle packing **Flow rate**: 1.0 mL/min **Wavelength**: 210nm **Detector**: photodiode array
16.	Stability Indicating Simultaneous Validation of Telmisartan and Cilnidipine with Forced Degradation Behavior Study by RP-HPLC in Tablet Dosage Form[43].	**Column**: C18 250×4.6mm, 5 μm **Mobile phase**: Acetonitrile (ACN): buffer pH 3.0 with Orthophosphoric acid (68: 32) **Flow rate**: 1.0 mL/min **Wavelength**: 245nm **Detector**: photodiode array
17.	RP-HPLC Estimation of Ramipril and Telmisartan in Tablets[44].	**Column**: C18 column having dimensions of 4.6×250 mm and particle size of 5µm **Mobile phase**: 0.01 M potassium dihydrogen phosphate buffer (adjusted to pH 3.4 using orthophosphoric acid): methanol: acetonitrile (15:15:70 v/v/v) **Flow rate**: 1.0 mL/min **Wavelength**: 210nm **Retention Time**: ramipril (R_t: 3.68 min) and telmisartan (R_t: 4.98 min)
18.	Development and Validation of RP-HPLC Method for simultaneous estimation of Telmisartan, Amlodipine Besylate, and Hydrochlorothiazide in their tablet dosage form [45].	**Column**: C18 kinetex column (250 × 4.6 mm, 5 µ) **Mobile phase**: Acetonitrile: 20mM phosphate buffer (pH 3.0) (60:40 %, v/v) **Flow rate**: 1.0 mL/min **Wavelength**: 258nm
19.	Development And Validation of a Stability Indicating RP-HPLC Method For Simultaneous Determination of Telmisartan and Amlodipine in Combined Dosage form[46].	**Column**: Hypersil BDS C18 Column (100 mm x 4.6 mm, 5µ.) **Mobile Phase**: Phosphate Buffer (pH 3.6): Acetonitrile (60:40) v/v **Flow rate**: 1 mL/min. **Wavelength**: 234 nm **Linearity**: TEL -10–150µg/ml AMLB -1–20 µg/ml **Retention Time**: TEL – 4.1 min. AMLB– 2.6 min.
20.	Stability-Indicating RP-UHPLC Method For Determination of Telmisartan in Drug Substance and Marketed Formulation[47].	**Column**: Poroshell 120EC-C18 column (4.6 x 50mm, 2.7µm) **Mobile Phase**: Acetonitrile: 50mM ammonium acetate buffer (45:55) v/v, (pH 4.5) acetic acid. **Flow rate**: 1ml/min. **Wavelength**: 290 nm
21.	Development and Validation of Analytical Method for Simultaneous Estimation of Bisoprolol Fumarate and Telmisartan by Using RP HPLC Method[48].	**Column**: Waters X Bridge RP C18(250mm x 4.6 mm,5 µm) **Mobile Phase**: Methanol and water (75:25 v/v) **Flow Rate**: 1ml/min. **Wavelength**: 231nm **Linearity**: BIS:5-25µg/ml TEL: 40-200µg/ml **Retention Time**: BIS-5.7 min. TEL -7.6min.
22.	A New RP-HPLC method for simultaneous estimation of Telmisartan and Cilostazol in the synthetic mixture[49].	**Column**: C18G (250 mm × 4.6 mm, 5 µm) **Mobile Phase**: Potassium dihydrogen phosphate buffer (10mM): Methanol: Acetonitrile (30:10:60) v/v/v (pH 5.8) **Flow rate**: 1.0 mL/min.

		Wavelength: 257 nm **Linearity**: TEL -2-10 µg/ml, CIL- 4-20 µg/ml **Retention Time**: TEL: 9.6 min. CI L: 5.49 min.
23.	Method Development and Validation for Simultaneous Estimation of Telmisartan and Chlorthalidone by RP-HPLC in Pharmaceutical Dosage Form[50].	**Column**: CAPCELL C18 (250mm×4.6mm, 5µm) **Mobile Phase**: Potassium di hydrogen ortho phosphate buffer: Acetonitrile: Methanol (35:45:20) v/v/v (pH 3.5) Ortho phospheric acid **Flow Rate**:0.8 mL/min. **Wavelength**:296nm **Linearity**: TEL -20- 100µg/mL, CHLT: 6.25-31.25 µg/mL **Retention Time**: TEL- 4.97 min. CHLT: 3.46 min.
24.	Development and Validation RP-HPLC Method for Simultaneous Estimation of Telmisartan and Nifedipine in Synthetic Mixture[51].	**Column**: Phenomenex Luna C18(250mm×4.6mm,5µ) **Mobile Phase**: ACN: Water: Methanol (10:20:70 v/v/v) pH 3.8 **Wavelength**: 234 nm **Flow rate**: 1 ml/min **Linearity**: TEL: 4-20 μg/ml, NIF: 2-10 μg/ml **Retention Time**: TEL: 2.563 min NIF: 4.403 min
25.	Development and Validation of Rapid RP-HPLC Method for the Detection and Quantification of Telmisartan Incorporated in Dosage Forms and Plasma[52].	**Column**: C18 column (4.6 mm×250 mm, 5 µm) **Mobile Phase**: Acetonitrile: Methanol: 0.01 M sodium dihydrogen orthophosphate (41:10:49) v/v/v (pH 3.0) Orthophosphoric acid **Wavelength**: 291 nm **Flow rate**: 0.8 mL/min **Linearity**: 0.1-10µg/ml **Retention Time**: 2.4 min.
26.	A Validated RP-HPLC Method for Tablets Containing Amlodipine Besylate and Telmisartan HCl as Active Pharmaceutical Ingredient[53].	**Column**: Phenomenix C18 (250 mm × 4.6 mm, 5 µm) **Mobile Phase**: 0.02M Ammonium Phosphate buffer: Acetonitrile: Methanol (40:35:25) v/v/v **Flow rate**: 1.0mL/min. **Wavelength**: 254nm: TEL – 0.8 -160 µg/ml AMLB – 0.1-2 µg/ml **Retention Time**: TEL -2.65 min. AMLB – 4.996 min.
27.	Analytical Method Development and Validation for The Simultaneous Estimation of Metformin and Telmisartan in Bulk and Pharmaceutical Dosage Forms Using RP-HPLC Method[54].	**Column**: BDS (250mm x 4.6 mm, 5 µ) **Mobile Phase**: Buffer: Acetonitrile: Methanol (35:55:10) v/v/v **Flow rate**: 1mL/min **Wavelength**: 237nm **Linearity**: MET: 5-30µg/ml TEL: 62.5-375µg/ml **Retention Time**: MET- 2.4 min. TEL-3.2 min.
28.	Development and Validation of Bioanalytical HPLC Method For Estimation of Telmisartan in Rat Plasma: Application to Pharmacokinetic Studies[55].	**Column**: Phenomenex Luna® C8 (300mm× 4.6 mm,5µ) **Mobile Phase**: Methanol: Acetonitrile (70:30 (v/v) **Flow rate**: 1 ml/min **Wavelength**: 190-800 nm **Linearity**: 10 - 1000 µg/ml **Retention Time**: 2.3 min.
29.	Analytical Method Development and Validation for the Simultaneous Estimation of Telmisartan and Atorvastatin in Bulk and Tablet Dosage Form[56].	**Column**: Inertsil-ODS C18 (250mm×4.6mm,5µ) **Mobile Phase**: Methanol:water(50:50) v/v **Wavelength**: 250 nm **Flow rate**:1mL/min **Linearity**: 20 to 80 µg/ml **Retention Time**: TEL -2.4 min. ATC – 3 min.
30.	Development and Validation of HPTLC Method for Simultaneous Estimation of Amlodipine Besylate, Hydrochlorothiazide and Telmisartan in Their Combined tablet dosage form[57].	**Stationary phase**: pre-coated with silica gel 60F254(10×10 cm) **Mobile Phase**: Chloroform: Butanol: Ammonia (6: 4: 0.1) v/v/v **Flow Rate**: 1 mL /min. **Wavelength**: AML- 237.5 nm, HCTZ - 270 nm, TLM- 297nm **Retention Time**: AML – 3.2 min. HCTZ – 3.1 min. TEL – 3.5 min.
31.	Simultaneous Estimation of Telmisartan and Atorvastatin calcium in API and tablet dosage form[58].	**Column**: Boston ODS C18 (250mm x 4.6 mm, 5 µ) **Mobile Phase**: Methanol: Acetonitrile: buffer (35:25:40) v/v **Flow rate**: 1.0mL/min. **Wavelength**: 235nm **Linearity**: 60-140µg/ml **Retention Time**: TEL -3.5 min. ATC -2.3 min.

32.	A Fast and Validated Reversed-Phase HPLC Method for Simultaneous Determination of Simvastatin, Atorvastatin, Telmisartan and Irbesartan in Bulk Drugs and Tablet Formulations[59].	**Column**: C18 (75 mm × 4.6 mm ,3.5 µ) **Mobile Phase**: Ammonium acetate buffer (10 mM (pH 4.0): Acetonitrile (40:60) v/v **Flow rate**: 1mL/min **Linearity**: 1–16 µg/mL **Wavelength**: 220nm **Retention Time**: IRB – 1.20 min. ATV – 1.82 min. TLM – 2.40 min. SMV – 6.03 min.
33.	Analytical Method Development and Validation of First Order Derivative Spectrophotometric Method for Simultaneous Estimation of Telmisartan and Metformin Hydrochloride in their Combined Pharmaceutical Dosage Form[60].	**Model**: Shimadzu model1700 **Diluents**: Methanol: Water (50: 50) v/v **Method**: First Order Derivative **Linearity**: TEL- 6-16 µg/mL MET- 6-16 µg/mL **Wavelength**: TEL- 251 nm MET- 217 nm
34.	QbD-based development of HPLC method for simultaneous quantification of Telmisartan and Hydrochlorothiazide impurities in tablets dosage form[61].	**Column**: Kromosil C18(125mm× 4.0 mm, 5 µm), Inertsil ODSV (150 mm 4.6 mm, 3.5 µm) **Mobile Phase**: **Solvent A**: Potassium dihydrogen phosphate buffer, (pH 3.5) 1%Ortho phosphoric acid solution **Solvent B**: Purified water and acetonitrile (100:900) v/v **Flow rate**: 1.0 mL/min. **Wavelength**: 230 nm **Linearity**: TEL -1.5 µg/mL HCZ - 0.6 µg/ml **Retention Time**: 3.2 min.
35.	Method Development and Validation of Simultaneous Estimation of Cilostazol and Telmisartan[62].	**Model**: Shimadzu model 1700 double beam UV-Visible spectrophotometer S **solvent**: Methanol **Methods**: 1. Simultaneous Equation method 2. Absorbance Ratio method **Wavelength**: TEL- 258 nm, 237.5 nm CLZ– 258 nm, 237.5nm **Linearity**: TEL-1 -5 µg/ml CLZ - 4-20 µg/ml
36.	RP-HPLC method for estimation of Telmisartan in human plasma[63].	**Column**: HibarC18 (250 mm x 4.6 mm ,5 µm) **Mobile Phase**: Ammonium Formate solution (pH 4.0): Methanol (70:30), v/v **Flow Rate**: 1 mL/min **Wavelength**: 275 nm **Linearity**: 0.1-1.5 (µg/ml) **Retention Time**: 3.7 min.
37.	Development and Validation of RP-HPLC Method for Estimation of Telmisartan in Bulk and Tablet Dosage Form[64].	**Column**: C18 sun fire column (250mmx4.6mm,5µm) **Mobile Phase**: Potassium di-hydrogen Phosphate: Acetonitrile (60:40) v/v **Flow Rate**: 1mL/min **Wavelength**:243nm **Linearity**: 50 -150 µg/ml **Retention Time**: 3.4 min.
38.	Analytical Method Development and Validation for the Simultaneous Estimation of Telmisartan and Hydrochlorthiazide by RP HPLC method in Bulk and Tablet Dosage Form[65].	**Column**: Agilent C18 (4.6 mm×150mm,5µ) **Mobile Phase**: Methanol: Acetonitrile (70: 30) v/v **Flow rate**: 1ml/min **Wavelength**: 240nm **Linearity**: TEL: 15- 55µg/ml HCTZ :50 -250µg/ml **Retention Time**: TEL-1.8min. HCTZ-2.4min.
39.	Development and Validation of UV Visible Spectrophotometric Method for Estimation of Cilnidipine and Telmisartan in Bulk and Dosage Form[66].	**Model**: Shimadzu UV/Visible double beam spectrophotometer (Model 1700) **Solvent**: Acetonitrile **Wavelength**: TEL -241nm CIL - 203nm **Linearity**: TEL -0.5-2.5 µg/ml CIL - 2-10µg/ml
40.	UV Spectrophotometric method development and Validation for Telmisartan in Bulk and Tablet Dosage Form[67].	**Model**: Shimadzu UV- 1700 **Solvent**: 0.1 N NaOH, Distilled water **Wavelength**: 234nm **Linearity**: 2-10 µg/ml

41.	Dissolution Method Development and Validation for Tablet Dosage form of Telmisartan Using UV Spectrophotometric Method[68]	**Model**: Double beam UV visible spectrophotometer Shimadzu UV 1800 **Diluent**: Methanol **Wavelength**:296nm **Linearity**: 2-12µg/ml
42.	UV-Spectrophotometric Determination for Simultaneous Estimation of Amlodipine Besylate and Telmisartan in Combination[69]	**Model**: UVA 1002 E **Solvent**: 0.1 N HCL **Method: 1. Absorbance correction method,** **2. Absorbance ratio Method** **Wavelength**: TELM –292 nm AMLB- 326 nm **Linearity**: **Method 1. – Absorbance correction method** TEL - 3-24 µg/ml AMLB - 0.5-20 µg/ml **Method 2. - Absorbance ratio Method** TEL- 3-24 µg/ml AMLB- 0.5-15.5 µg/ml
43.	Development of UV spectrophotometric method for estimation and Validation of Telmisartan as a pure API[70]	**Model**: Shimadzu UV1800 UV-Visible double beam spectrophotometer **Solvents**: Ethanol (95%), 0.1 N NaHCO3 **Wavelength**: 240nm **Linearity**: 2-14 µg/ml
44.	Absorbance correction method for estimation of Telmisartan and Metoprolol succinate in combined tablet dosage forms[71]	**Model**: UV-Visible double beam spectrophotometer Shimadzu UV1800 **Solvent**: Methanol **Method: Absorbance correction method** **Wavelength**: TEL - 296nm MET - 223nm **Linearity**: TELM - 2-16 µg/ml MET- 3 -24 µg/ml
45.	Development and Validation of a Solvent Extraction UV Spectrophotometric Method for the Estimation of Rosuvastatin Calcium and Telmisartan in Combined Dosage Form[72]	**Model**: UV-Visible double beam spectrophotometer Shimadzu 1800 **Solvents**: Telmisartan- methanol and Rosuvastatin Calcium- phosphate buffer pH 5.5 **Wavelength**: Rosuvastatin Calcium-242.8nm and Telmisartan- 295.2 nm
46.	Analytical Method Development and Validation for Telmisartan, Chlorthalidone and Amlodipine by UV- Spectroscopic Method[73]	**Model**: JASCO-V-530. UV-Visible Spectrophotometer **Solvents**: Methanol **Wavelength**: 311nm- Telmisartan, 228nm-Chlorthalidone and 253nm- Amlodipine)

TABLE 5: REPORTED METHODS FOR ASSESSMENT OF AZELNIDIPINE AND TELMISARTAN

Sr. no.	Title/Method	Description
1.	Development of HPLC stability demonstrating methodology for quantifying Azelnidipine and Telmisartan in tablets and bulk[74]	**Column**: 250 mm length C18 column (Supelco, 4.6 mm inner diameter, 5.0 µm particle size) **Mobile phase**: 0.1M Na_2SO_4 (pH 3.6) and acetonitrile (55: 45% v/v) **Flow rate**: 1.0 mL/min **Wavelength**: 258nm **Detector**: photodiode array
2.	Analytical Method Development and Validation of Azelnidipine and Telmisartan by RP HPLC Method[75]	**Column**: C18 (4.6 × 150 mm, 5 mm) **Mobile phase**: Buffer 0.01 N KH2PO4: Acetonitrile (45:55 % v/v) **Flow rate**: 1.0 mL/min **Wavelength**: 290nm **Retention time**: Azelnipidine- 2.131 min Telmisartan- 2.593 min
3.	Stability Indicating RP-HPLC Method Development and Validation for the Simultaneous Estimation of Telmisartan and Azelnidipine in Tablet Dosage Form[76]	**Column**: Hyperchrom ODS C18 Column (250*4.6mm) **Mobile phase**: Buffer 0.05M Potassium dihydrogen ortho phosphate Buffer (pH-4.0): Methanol (60:40) **Flow rate**: 1.0 mL/min **Wavelength**: 215nm **Retention time**: Telmisartan- 3.440min Azelnidipine- 5.693min.
4.	Telmisartan and Azelnidipine quantification employing HPLC statagram; Stability	**Column**: C18 Kromasil stationary column (5 µm, 250 mm × 4.6 mm)

	investigation on Telmisartan and Azelnidipine[77]	**Mobile phase**: 0.1M NaH2PO4 solution (pH 3.5) and methanol at a comparative volume ratio of 50% each. **Flow rate**: 1.0 mL/min **Wavelength**: 256nm
5.	A stability indicating RP-HPLC method validation for simultaneous estimation of Azelnidipine and Telmisartan in a fixed-dose combination[78]	**Column**: Inertsil C-18 Column with 150×4.6 mm× 5 µm **Mobile phase**: Acetonitrile and buffer **Flow rate**: 1.5 mL/min **Wavelength**: 254nm
6.	Development and Validation of UV Spectrophotometric method for the simultaneous estimation of Azelnidipine and Telmisartan in combined dosage form[79]	**Model:** JASCO double beam UV-vis spectrophotometers **Wavelength:** 200-400 nm **Solvent:** Methanol
7	RP-HPLC Method for Determination of Azelnidipine and Telmisartan in Pharmaceutical Dosage Form [80]	**Column:** Intersil C18 column (250 × 4.6mm × 5µm) **Mobile phase:** Acetonitrile: 5 millimolar phosphate buffer pH 4.6 (70:30 v/v) **Flow rate:** 1mL/min **Wavelength:** 255nm
8	Method development and Validation for Simultaneous Quantification of Azelnidipine and Telmisartan in Pharmaceutical dosage form by UV [81].	**Model:** JASCO double beam UV-vis spectrophotometers **Wavelength:** 200-400 nm **Solvent:** Methanol
9	Analytical method development and validations for simultaneous estimation of antihypertensive drugs [82]	**Column**: C 18 column (250mm x 4.6mm, 5µm) **Mobile phase**: A- (0.1% formic acid in water as an aqueous phase) B- (acetonitrile as an organic modifier) **Flow rate**: 0.8 ml/min **Wavelength**: 260nm **Retention time:** Telmisartan- 5.950 min **Azelnidipine**: 7.293min

CONCLUSION: This review article presents the Physicochemical properties and Pharmacological actions of Azelnidipine and Telmisartan. The presented review gives information about the various methods reported in the literature for determining Azelnidipine and Telmisartan, including official pharmacopeial assay methods.

This review concluded that different analytical methods are reported for the estimation of Azelnidipine and Telmisartan individually and other combinations like UV Spectroscopy, HPLC, HPTLC, and LC-MS. Hence, all methods were simple, accurate, precise, and reproducible. The Literature review focuses on various UV and HPLC methods reported for Azelnidipine and Telmisartan in fixed-dose combinations. This review will help develop the analytical methods for this new combination and give knowledge about both hypertensive drugs' characteristics.

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REFERENCES:

1. PubChem. Azelnidipine Accesed April 2023. https://pubchem.ncbi.nlm.nih.gov/compound/ Azelnidine
2. National Center for Biotechnology Information (2022). PubChem Compound Summary for `CID 65948, Azelnidipine. Retrieved August 24.
3. Wienen W, Entzeroth M, van Meel JC, Stangier J, Busch U, Ebner T, Schmid J, Lehmann H, Matzek K, Kempthorne-Rawson J and Gladigau V: A review on telmisartan: a novel, long-acting angiotensin II-receptor antagonist. Cardiovascular Drug Reviews 2000; 18(2): 127-54.
4. Gosse P: A review of telmisartan in the treatment of hypertension: blood pressure control in the early morning hours. Vascular Health and Risk Management 2006; 2(3): 195-201.
5. Mandale D, Mistry R and Chauhan N: An Analytical Approach of Azelnidipine: a Review. World J Pharm Pharm Sci 2021; 10: 682-92.
6. Singh A, Jha KK, Mittal A and Kumar A: Journal of Scientific & Innovative Research 2013; 2: 160-173.
7. Ram CV: Therapeutic Usefulness of a Novel Calcium Channel Blocker Azelnidipine in the Treatment of Hypertension: A Narrative Review. Cardiology and Therapy 2022; 1-7.
8. Unger T and Schupp M: Telmisartan: from lowering blood pressure to end-organ protection.

9. Government of India, Ministry of Health. Pharmacopoeia of India: (the Indian Pharmacopoeia). Delhi: Manager of Publications, 7th edition 2018.
10. Patel J and Patel N: Validated Stability-Indicating RP-HPLC Method for the Simultaneous Determination of Azelnidipine and Olmesartan in their Combined Dosage Form. Scientia Pharmaceutica 2014; 4:541–554.
11. Raskapur D and Patel M: UV-Spectrophotometric method development and Validation for Determination of Azelnidipine in Pharmaceutical Dosage Form. International Journal of Pharmacy and Pharmaceutical Sciences 2012; 4: 238-240.
12. Rane A and Mahajan S: Validation and Forced Stability-Indicating HPTLC method for determination of azelnidipine. World Journal of Pharmaceutical Research 2016; 5: 1053-1062.
13. Patel N and Patel J: Simultaneous Determination of Azelnidipine and Olmesartan medoxomil by First Derivative Spectrophotometric Method. Der Pharmacia Lettre 2012; 4: 1080-1084.
14. Rele R: Spectrophotometric Estimation of Azelnidipinein bulk and pharmaceutical dosage form by second order derivative methods. Journal of Chemical and Pharmaceutical Research 2014; 6: 198-202.
15. Prabhakar D, Sreekanth J and Jayaveera K: Method Development and Validation of Azelnidipineby RP-HPLC. International Journal of Chem Tech Research 2017; 10: 418-423.
16. Gore M and Dabhade P: RP-HPLC Method Development and Validation of Azelnidipine. International Journal of Pharmaceutical Science and Research 2016; 7: 5111-5114.
17. Suneetha S: Sensitive Analysis of Azelnidipine and Related Derivative in Human Plasma by Ultra-Performance Liquid Chromatography-Tandam Mass Spectrometry. Asian Journal of Chemistry 2013; 15: 10319-10321.
18. Kawabata K and Urasaki Y: Simultaneous determination of Azelnidipine and two metabolites in human plasma using liquid chromatography-tandem mass spectrometry. Journal of Chromatography B 2006; 4: 45-52.
19. Modi J, Patel S and Upadhyay U: Stability Indicating Analytical Method Development and Validation For estimation of Azelnidipine. World Journal of Pharmaceutical Research 2016; 5: 831-847.
20. Amin A and Saad M: Simultaneous Determination of Azelnidipine and Olmesartan Medoxomil in Pharmaceutical Dosage Forms by UFLC Method. Journal of Pharmaceutical Science and Technology 2016; 6: 69 - 74.
21. Imdad H, Amit K and netra P: Analytical method development and Validation of Azelnidipine by UV-visible spectroscopy. World Journal of Pharmaceutical Research 10: 2277– 7105.
22. Sneha Ubale, Kalshetti M and Bhavana H: Development and Validation of RP-HPLC method for quantification of Azelnidipine in tablet.International Journal of Creative Research Thoughts 2021; 9: 2320-2882.
23. Sushil D, Rishikesh S and Pavan B: Development and Validation of Stability Indicating RP-HPLC Method for Azelnidipine for bulk drug. Natural Volatiles and Essential Oils 2021; 8: 11151-11157.
24. Sandeep S, Pooja C and Sanjay J: Stability-Indicating LC Method for Quantification of Azelnidipine: Synthesis and Characterization of Oxidative Degradation Product. TurkishJournal of Pharma Science 2021; 18: 550–556.
25. Muhammad S, Venugopala N and Anroop N: Mathematically Processed UV Spectroscopic Method for Quantification of Chlorthalidone and Azelnidipine in bulk and formulation. Journal of Spectroscopy 2022; 13.
26. Dibya D, Dhiman H, Himangshu S, Pintu K and Tapan K: Special emphasis on bioanalytical method development and Validation of an anti-hypertensive drug azelnidipine by LC-ESI-MS/MS in healthy human volunteer's blood plasma. Research Journal of Pharmacy and Technology 2021; 14: 3571-3577.
27. The Indian Pharmacopoeia. The Indian pharmacopeia commission; Ghaziabad, 7th Edition 2018.
28. Bhadoriya U, Dhaked H and Danodia K: RP-HPLC Method development and Validation for estimation of Telmisartan in bulk and tablet dosage form. International Journal of Drug Regulatory Affairs 2013; 1: 61-64.
29. Kishanta P, Uma M and Kanhu S: Method development and Validation of telmisartan in bulk and pharmaceutical dosage forms by UV spectrophotometric method. International Journal of Research in Pharmaceutical Sciences 2011; 2: 526-530.
30. RajeshJ, Milind B and Jagdish V: UV-spectrophotometric analytical method development and Validation for determination of telmisartan in pharmaceutical drug and drug product. International Journal of Current Advanced Research 2018; 7: 13292-13296.
31. Sahu L and Patro S: Stability Indicating assay of telmisartan in tablets. International Journal of Pharmaceutical Sciences and Research 13: 439-444.
32. Komal P, Komal D and Chaganbhai P: Stress degradation studies on Telmisartan and development of a validated method by UV spectrophotometry in bulk and pharmaceutical dosage forms. Pharmaceutical Methods 2: 253–259.
33. Chitra P, Ganesa S and Arumugam K: Determination of Telmisartan by HPTLC – A StabilityIndicating Assay. Journal of Planar Chromatography 2007; 6: 477–481.
34. Rafiq Z and Rauza B: Stability Indicating HPLC method for the determination of telmisartan as bulk drug and in pharmaceutical dosage form. International Journal of Chemical Science 2008; 6: 975-981.
35. Londhe S, Kaul N and Agrawal H: Stability-Indicating RP-HPLC Method for Analysis of Telmisartan in the Bulk Drug and in Formulations. Acta Chromatographica 2010; 22: 539–548.
36. Lakshmi K, Lakshmi S and Krishanu P: Stability indicating HPTLC method for simultaneous determination of Telmisartan and Ramipril in tablets. International Journal of Pharmacy and Pharmaceutical Sciences 2010; 2.
37. Kaliappan L, Pushpangadhan S and Shiji K: Development and Validation of Stability Indicating HPTLC and HPLC Methods for Simultaneous Determination of Telmisartan and Atorvastatin in their Formulations. Journal of Chemistry 2013; 9.
38. Laxman V, Mrinalini C and Amol S:AValidated Stability Indicating HPTLC method for simultaneous estimation of ramipril and telmisartan. International Journal of Pharmaceutical Sciences Review and Research 2010; 2.
39. Santosh R and Padmanabh B: Development and Validation of Stability-Indicating HPTLC Method for Simultaneous Determination of Telmisartan and Cilnidipine in Combined Tablet Dosage form. International Journal of Pharmaceutical Sciences and Drug Research 2015; 7: 478-483.
40. Rameshwar G, Sanjay P and Sailesh W: Stability-indicating RP-HPLC method development and Validation for simultaneous estimation of telmisartan and rosuvastatin calcium in bulk and in tablet dosage form. Future Journal of Pharmaceutical Sciences 2021; 7:224.

41. Rama R, Praveen K and Krishna R: Stability-indicating hplc method for simultaneous estimation of low-level impurities of telmisartan and hydrochlorothiazide in tablet dosage forms. International Journal of Pharmacy and Pharmaceutical Sciences 2012; 4.
42. Majan N, Aejaz A and Khan G: Stability indicating reverse-phase high- performance liquid chromatography method development and Validation for simultaneous estimation of Telmisartan and benidipine hydrochloride in pharmaceutical dosage form. Asian Journal of Pharmcaceutical and Clinical Research 2018; 11.
43. Reema H and Hitendra J: Stability Indicating Simultaneous Validation of Telmisartan and Cilnidipine with Forced Degradation Behavior Study by RP-HPLC in Tablet Dosage Form. International Scholarly Research Notices 2013; 6: 461.
44. Kurade V, Pai M and Gude R: RP-HPLC Estimation of Ramipril and Telmisartan in Tablets. Indian journal of Pharmaceutical Sciences 71: 148-151.
45. Ashwini P, Sandeep S and Sanjay K: Development and Validation of RP-HPLC Method for simultaneous estimation of Telmisartan, Amlodipine Besylate and Hydrochlorthiazide in their tablet dosage. Asian Journal of Pharmaceutical Analysis 2017; 7: 189-195.
46. Kumar S, Venkateshwar R and Kumar M: Development and Validation of a Stability Indicating RP-HPLC Method For Simultaneous Determination of Telmisartan and Amlodipine In Combined Dosageform. Asian Journal of Pharmaceutical and Clinical Research 2014; 7: 32-35.
47. Patra R, Mohan S and Gowda N: Stability-Indicating RP-UHPLC Method For Determination of Telmisartan in Drug Substance and Marketed Formulation. International Journal of Pharmaceutical Sciences and Research 2016; 7: 2031-2039.
48. Barge V, Gaikwad R and Chaudhari F: Development and Validation of Analytical Method for Simultaneous Estimation of Bisoprolol Fumarate and Telmisartan by Using RP HPLC Method. International Journal of Pharmaceutical and Clinical Research 2018; 10: 219-223.
49. Patel R: A New RP-HPLC method for simultaneous estimation of Telmisartan and Cilostazol in the synthetic mixture. International Journal of Recent Scientific Research 2015; 6: 3306-3310.
50. Vanaja N, Preethi CH: Method Development and Validation for Simultaneous Estimation of Telmisartan and Chlorthalidone by RP-HPLC in Pharmaceutical Dosage Form. Asian Journal of Pharmaceutical Analysis 2015; 5: 171 -177.
51. Doshi Z, Shah J and Zeel T: Development and Validation RP-HPLC Method for Simultaneous Estimation of Telmisartan and Nifedipine in Synthetic Mixture. Asian Journal of Pharmaceutical Technology and Innovation 2016; 4: 1-10.
52. Kaur L and Singh G: Development and Validation of rapid rp-hplc method for the detection and quantification of telmisartan incorporated in dosage forms and plasma. Journal of Pharmaceutical Research and Therapeutics 2020; 1: 78-83.
53. Sumaiya S and Bhardwaj A: A Validated RP HPLC Method for Tablets Containing Amlodipine Besylate and TelmisartanHCl as Active Pharmaceutical Ingredient. Modern Chemistry and Applications 2018; 8: 276 -279.
54. Gayathri P and Goud S: Analytical Method Development and Validation for the Simultaneous Estimation of Metformin and Telmisartan in Bulk and Pharmaceutical Dosage Forms Using Rp-HPLC Method. World Journal of Pharmacy and Pharmaceutical Sciences 2015; 4: 753-762.
55. Patel J and Dhingani A: Development and Validation of Bioanalytical HPLC Method for Estimation of Telmisartan in Rat Plasma: Application to Pharmacokinetic Studies. Dhaka University J of Pharma Scienc 2015; 11: 121-127.
56. Prashanth N: Analytical Method Development and Validation for the Simultaneous Estimation of Telmisartan and Atorvastatin in Bulk and Tablet Dosage Form. International Journal of Applied Pharmaceutical Sciences and Research 2020; 5: 312 -319.
57. Marolia B and Desai A: Development and Validation of HPTLC Method for Simultaneous Estimation of Amlodipine Besylate, Hydrochlorothiazide and Telmisartan in Their Combined Tablet Dosage Form. Pharmaceutical Methods 2016; 7: 48– 53.
58. Bangaruthali J, Harini V and Eswar N: Simultaneous estimation of Telmisartan and Atorvastatin calcium in API and tablet dosage form. Journal of Drug Delivery and Therapeutics 2019; 9: 175– 179.
59. Alhazmi A and Alnami H: A Fast and Validated Reversed-Phase HPLC Method for Simultaneous Determination of Simvastatin, Atorvastatin, Telmisartan and Irbesartan in Bulk Drugs and Tablet Formulations. Scientia Pharmaceutica 2018; 2:86-89.
60. Krishti A, Baraka J and Dasvani B: Analytical Method Development and Validation of First Order Derivative Spectrophotometric Method for Simultaneous Estimation of Telmisartan and Metformin Hydrochloride in their Combined Pharmaceutical Dosage Form. International Journal of Pharmaceutical Quality Assurance 2020; 11: 60-68.
61. Palakunthi A and Dongala T: QbD based development of HPLC method for simultaneous quantification of Telmisartan and Hydrochlorothiazide impurities in tablets dosage form. Practical Laboratory Medicine 2020; 21: 108-112.
62. Damor D, Patel B and Mittal K: Method Development and Validation of Simultaneous Estimaton of Cilostazol and Telmisartan. Journal of Pharmaceutical Analysis 2015; 4: 41-48.
63. Ashok P and Narendran S: RP-HPLC method for estimation of Telmisartan in human plasma. International Journal of Applied Pharmaceutics 2019; 2: 237 -240.
64. NandipatiS, Reddy V: Development and Validation of RP-HPLC Method for Estimation of Telmisartan in Bulk and Tablet Dosage Form. International Research Journal of Pharmaceutical and Applied Science 2012; 2: 39-43.
65. Kanaka L, Harshini S and Haque A: Analytical Method Development and Validation for the Simultanious Estimation of Telmisartan and Hydrochlorthaizide by RP HPLC method in Bulk and Tablet Dosage Form. Journal of Pharmaceutical and Biomedical Analysis Letters 2016; 4: 1-8.
66. Thakare C, Ahmed S and Shastry M: Development and Validation of UV Visible Spectrophotometric Method for Estimation of Cilnidipine and Telmisartan in Bulk and Dosage Form. Indo American Journal of Pharmaceutical Research 2017; 7: 8552–8555.
67. Rathod S, Patil M and Santosh A: UV Spectrophotometric method development and Validation for Telmisartan in Bulk and Tablet Dosage Form. International Journal of Pharmaceutical Sciences and Research 2012; 3: 3936-3939.
68. Kumar M, Kumar C: Dissolution Method Development and Validation for Tablet Dosage form of Telmisartan Using UV Spectrophotometric Method. Journal of Chemical and Pharmaceutical Research 2018; 10: 148-156.

69. Hirpara K and Pave M: UV-Spectrophotometric Determination for Simultaneous Estimation of Amlodipine Besylate and Telmisartan in Combination. Journal of Pharmaceutical Science and Bioscientific Research 2012; 2: 133-137.
70. Chivate N, Patil S and Saboji J: Development of UV spectrophotometric method for estimation and Validation of Telmisartan as a pure API. Journal of Pharmaceutical Research 2012; 5: 3331-3333.
71. Patel K and Patel A: Absorbance correction method for estimation of Telmisartan and Metoprolol succinate in combined tablet dosage forms. Pharmaceutical Methods 2012; 3: 106-110.
72. Elseena J, Anjana C, Merlin K and Vishnu G: Development and Validation of a Solvent Extraction UV Spectrophotometric Method for the Estimation of Rosuvastatin Calcium and Telmisartan in Combined Dosage Form. 2022; 15: 2065-2069.
73. Rutuja M, Sarika R, Vaibhavi V and Rajkumar V: Analytical Method Development and Validation for Telmisartan, Chlorthalidone and Amlodipine by UV-Spectroscopic Method 2021; 14: 6049-6054.
74. Krishnaphanisri P and Sunitha K: Development of hplc stability demonstrating methodology for quantifying azelnidipine and telmisartan in tablets and bulk types. 2021; 13.
75. Spandana V, Siddartha: Analytical Method Development and Validation of Azelnipidine and Telmisartan by RP HPLC Method. J of Pharma and Nanotech 2347-7857.
76. Mansi B, Pankti D and Neetu Dharu: Stability Indicating Rp-Hplc Method Development and Validation for the Simultaneous Estimation of Telmisartan and Azelnidipine in Tablet Dosage Form. International J of All Research Education & Scientific Methods 2021; 9: 2455-6211.
77. Spandana L and Subhashini P: Telmisartan and azelnidipine quantification employing hplc stratagem; stability investigation on telmisartan and azelnidipine. Inter J of Applied Pharmaceutics 2022; 14: 0975-7058.
78. Manish K, Umesh C and Pankaj G: A stability indicating RP-HPLC method validation for simultaneous estimation of azelnidipine and telmisartan in a fixed-dose combination. International Journal of Pharmaceutical Sciences and Drug Research 2021; 13: 288-294.
79. Kumara P and Unnathi Y: Development and Validation of UV Spectrophotometric Methodfor Simultaneous estimation of azelnidipine and telmisartan in Combined Dosage Form. World Journal of Pharmacy and Pharmaceutical Sciences 2021; 10: 1320-1332.
80. Manisha P, Vasudha D, Srinivas RY and Vara P: RP-HPLC Method for Determination of Azelnidipine and Telmisartan in Pharmaceutical Dosage Form. Research Journal of Pharmacy and Technology 2023.
81. Punugupati R, Eswarudu M and Puttugunta S: Method development and Validation for Simultaneous Quantification of Azelnidipine and Telmisartan in Pharmaceutical dosage form by UV. International Journal of Pharmaceutical Sciences Review and Research 2022.
82. Harshith K, Jinesh B, Bindhyashree K, Sahana K and K. Hanumanthachar J: Analytical Method Development and Validations for Simultaneous Estimation of Antihypertensive Drugs. European Journal of Pharmaceutical and Medical Research 2023; 10: 463-469.

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