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A Convenient Synthesis by Microwave Assisted High-Speed and Antibacterial Activity of Ethyl-4-aryl-6-methyl-2-oxo (or thioxo)-1,2,3,4-tetrahydropyrimidine-5-Carboxylate Derivatives without Solvent

N FOROUGHIFAR*, A. MOBINI KHALEDI, S.M. SHARIATZADEH, and M. MASOUDNIA
Chemistry and Biology Departments, Arak University, Dr. Beheshti Ave., Arak, Iran.
email: N_foroughifar@yahoo.com; akbar_mobini@yahoo.com

Ethyl 4-aryl-6-methyl-2-oxo (or thioxo)-1,2,3,4-tetrahydropyrimidine-5-carboxylate **4(a–h)** and 4-aryl-2-oxo (or thioxo)-1,2,3,4-tetrahydropyrimidine **6(a–c)** were synthesized under reflux and microwave-promoted without solvent and high-speed. These compounds were screened for antifungal and antibacterial activities test organisms.

Key Words: Synthesis, Microwave, Antibacterial activity, Ethyl-4-aryl-6-methyl-2-oxo (or thioxo 1,2,3,4-tetrahydropyrimidine-5-carboxylate.

INTRODUCTION

In addition to being essential components of naturally occurring nucleic acids, pyrimidines are integral parts of such biologically important compounds as antivirial, antitumor, antibacterial, anti-inflammatory[1], antihypertensive[2], cardiovascular agents[3], calcium channel blocking[4] (*e.g.*, nifedipine), α_{1a}-adrenegric antagonists[5] and neuropeptide Y (NPY) antagonists.[6]

Our continuing interest in searching the products for biological studies[7–14], was considered worthwhile to start with 4-aryl-6-methyl-2-thioxo-1,2,3,4-tetrahydropyrimidine-5-carboxylate (**4**) under reflux in boiling ethanol and microwave-promoted solvent-free variation of classical Biginelli condensation. The application of microwave irradiation in organic synthesis has been the focus of considerable attention in recent years and is becoming an increasingly popular technology.[13]

RESULTS AND DISCUSSION

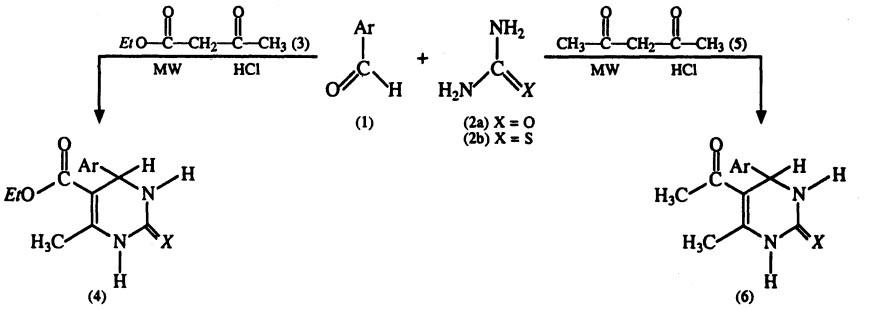
Compounds (**4**) of Biginelli condensation is named ethyl-4-aryl-6-methyl-2-oxo (or thioxo)-1,2,3,4-tetrahydropyrimidine carboxylate, were obtained in 50–82% yields which is more efficient way-eliminating the use of a solvent and reflux conditions-were investigated. The influence of microwave irradiation with 10–100% power level, neat mixture of β-keto ester (ethyl acetoacetate) (**3**) or

1,3-dicarbonyl compound (acetylacetone) **(5)**, arylaldehyde **(1)** urea or thiourea **(2a, 2b)** and HCl (cat) (Scheme I). In a typical experiment four reaction components are simply mixed in a glass beaker and irradiated in an unmodified household microwave oven for a few second to a few minutes. During microwave irradiation vessel is placed inside oven microwave, both the elemental analysis and spectral data of products **4(a–h)** and **6(a–c)** are inconsistent with the assigned structures. This strategy is therefore clearly applicable to the parallel synthesis of single compounds **4** and **6** schemes.

The IR, ^{1}H-nmr, ^{13}C-nmr, mass spectra and elemental analysis studies confirm the structure of compound **4f**. The IR spectrum of **4f** showed NH stretching vibration in the region of 3242–3118 cm^{-1}. The CH aromatic ring, olefinic and aliphatic stretching vibrations were observed in the region 3050–2900 cm^{-1}. The carbonyl absorption exhibited as a doublet at 1725–1702 cm^{-1}, which concerned to two carbonyl groups of **4f**. The olefinic stretching vibration (C=C) was observed at 1648 cm^{-1}. The aromatic ring stretching vibration (C=C) exhibited at 1570 and 1490 cm^{-1}. The absorption of stretching vibration C—O ester showed at 1221 and 1089 cm^{-1}. In the ^{1}H-nmr (DMSO-d_6) signals for protons of CH_3 appear as a singlet at 2.1 ppm. The CH_3 and CH_2 protons of ethyl group appeared as a quadruplet and triplet at 1.0 and 4.8 ppm respectively. The aromatic protons resonated in the region 7.1–7.3 ppm as a multiplet. The C-4 and N-3 protons appeared as a doublet and broad singlet at 4.8 and 7.6 ppm respectively, and proton of N-1 resonated at 9.0 ppm as a singlet. The ^{13}C-nmr (DMSO-d_6) of **4f**, showed the methyl carbon resonated at 14 and 18 ppm, the peak at 14 ppm was due to methyl of olefin, and 18 ppm was due to methyl of ethyl group. The methine carbon (C-4) resonated at 53 ppm. The methylene carbon (CH_2 of ester group) resonated at 59 ppm. The aromatic and olefinic carbons resonated in the region 99–149 ppm. The carbonyl of urea appeared at 151.9 ppm and the carbonyl of ester appeared at 165 ppm. The mass spectrum of **4f**, showed the molecular ion peak at m/z 294 (24%). The loss of methyl radical from the molecular ion gave a cation at m/z 279 (3%). The loss of ethoxy radical from the molecular ion gave a cation at m/z 249 (9%). The loss of aromatic radical from the molecular ion gave a cation at m/z 183 (100%) as a base peak.

IR, ^{1}H-nmr, ^{13}C-nmr, mass spectra and elemental analysis studies confirmed the structure of **6b**. Its IR spectrum showed NH stretching vibration in the 3283 and 3182 cm^{-1}. The CH aromatic ring, olefinic and aliphatic stretching vibrations were was observed in the region 3100–2900 cm^{-1}. The carbonyl absorption exhibited at 1621 cm^{-1}. The olefinic stretching vibration (C=C) was observed at 1600 cm^{-1}. The aromatic ring stretching vibration (C=C) was observed at 1590 and 1490 cm^{-1}. The ^{1}H-nmr (DMSO-d_6) signals for protons of CH_3 resonated at 2.0 and 2.1 ppm as a singlet. The aromatic protons resonated in the region 7.1–7.3 ppm as multiplet. The C-4 and N-3 proton resonated at 5.1 and 9.6 ppm as a doublet and broad singlet respectively, and proton of N-1 resonated at 10.1 ppm as a singlet. The ^{13}C-nmr (DMSO-d_6) of this compound **(6b)**, the methyl carbon resonated at 18 and 30 ppm, that 18 ppm was concerned to methyl of olefin and 30 ppm was concerned to methyl of carbonyl group. The methine carbon (C-4) resonated at 53 ppm. The aromatic and olefinic carbons resonated

in the region 110–145 ppm. The thiocarbonyl appeared at 174 ppm and the carbonyl appeared at 195 ppm. The mass spectrum of compound **(6b)**, the molecular ion was absorved at m/z 280 (100%) as a base peak. The loss of methyl radical from the molecular ion gave a cation at m/z 265 (25%). The loss of methyl carbonyl radical from the molecular ion gave a cation at m/z 237 (32%). The loss of aromatic radical from the molecular ion gave a cation at m/z 169 (68%).



4a	Ar = C_6H_5	X=O	1a	Ar = C_6H_5	X=O	6a	Ar = 4-ClC_6H_4	X=O
b	Ar = C_6H_5	X=S	b	Ar = C_6H_5	X=S	b	Ar = 4-ClC_6H_4	X=S
c	Ar = 4-$(NMe_2)C_6H_4$	X=O	c	Ar = 4-$(NMe_2)C_6H_4$	X=O	c	Ar = (3,4-MeO)C_6H_3	X=S
d	Ar = 4-$(NHCOCH_3)C_6H_4$	X=S	d	Ar = 4-$(NHCOCH_3)C_6H_4$	X=S			
e	Ar = (2-Cl-6-F)C_6H_3	X=S	e	Ar = (2-Cl-6-F)C_6H_3	X=S			
f	Ar = 4-ClC_6H_4	X=O	f	Ar = 4-ClC_6H_4	X=O			
g	Ar = 4-ClC_6H_4	X=S	g	Ar = 4-ClC_6H_4	X=S			
h	Ar = (3.4-MeO)C_6H_3	X=O	h	Ar = (3,4-MeO)C_6H_3	X=O			
i	Ar = 4-$(NMe_2)C_6H_4$	X=S (reflux)	i	Ar = 4-$(NMe_2)C_6H_4$	X=S			
j	Ar = 4-HOC_6H_4	X=S (reflux)	j	Ar = 4-HOC_6H_4	X=S			

EXPERIMENTAL

The melting points were determined using a electro thermal digital melting point apparatus and are uncorrected. IR spectra were recorded on a Perkin Elmer 1320 and Galaxy series FTIR 5000 spectrophotometer using samples in KBr disks. The ^{1}H-nmr and ^{13}C-nmr spectra were recorded on a Bruker 400 MHz spectrometer using TMS as internal standard. Mass spectra were obtained on a Finnigan mass spectrometere at 70 eV (EI) using a direct inlet system. Microanalyses were performed on a C, H, N amount Carlo Erba.

Ethyl 4-aryl-6-methyl-2-oxo (or thioxo)-1,2,3,4-tetrahydropyrimidine-5-carboxylate 4(a–e, h).

General preparation of products **4(a–e, h)** is according by condensation of a reaction mixture containing arylaldehyde **1(a–e, h)** urea or thiourea **(2a, 2b)**, ethyl acetoacetate **(3)** and a few drop of concentrated hydrochloric acid. We mixed three components for in a pyrex beaker and irradiated in an unmodified household microwave oven at known power level for a few seconds until a few minutes.

The mixture was allowed to cool and solid product was filtered, washed with ethanol and dried under vacuum. The solid was recrystalized to afford **4(a–e, h).**

Ethyl-6-methyl-2-oxo-4-phenyl-1,2,3,4-tetrahydropyrimidine-5-carboxylate (4a).

This compound was prepared by mixing of benzaldehyde **(1a)** (1.01 mL, 0.01 mole), urea **(2a)** (0.60 g, 0.01 mole), ethyl acetoacetate **(3)** (1.89 mL, 0.015 mole) and one drop of concentrated hydrochloric acid.

Power level = 100%, time of reaction: 30 seconds, mp 203–204°C, (2.13 g, 82%), IR (KBr): 3245–3180 (NH), 3040–2940 (CH aromatic, olefinic and aliphatic), 1730, 1710 (C=O), 1650 (C=C olefin), 1600, 1475 (C=C aromatic), 1230, 1100 (C—O ester) cm^{-1}; ^{1}H-nmr (DMSO-d_6): δ 1.1 (3H, t, J = 7.2 Hz, CH_3), 2.2 (3H, s, CH_3), 4.0 (2H, q, J = 7.2 Hz, CH_2), 5.2 (1H, d, J = 2.4 Hz, H-4). 7.3 (5H, s, aromatic protons), 7.8 (1H, bs, NH), 9.2 (1 H, s, NH).

Anal. Calcd. for $C_{14}H_{16}N_2O_3$: C, 64.61; H, 615; N, 10.77%. Found: C, 64.86; H, 6.19; N, 10.89%.

Ethyl 6-methyl-4-phenyl-2-thioxo-1,2,3,4-tetrahydropyrimidine-5-carboxylate (4b).

This compound was prepared by mixing of benzaldehyde **(1b)** (1.01 mL, 0.01 mole), thiourea **(2b)** (0.76 g, 0.01 mole), ethyl acetoacetate **(3)** (1.89 mL, 0.015 mole) and one drop of concentrated hydrochloric acid.

Power level = 100%, time of reaction: 40 seconds, mp 207–208 °C, (2.21 g, 80%), IR (KBr): 3340, 3180 (NH), 3100–2900 (CH aromatic, olefinic and aliphatic), 1675 (C=O), 1580 (C=C olefin), 1200, 1120 (C—O ester) cm^{-1};^{1}H-nmr (DMSO-d_6): δ 1.7 (3H, t, J = 7.2 Hz, CH_3), 2.3 (3H, s, CH_3), 4.0 (2H, q, J = 7.2 Hz, CH_2), 5.3 (1H, d, J = 3.6 Hz, H-4), 7.3 (5H, s, aromatic protons), 9.6 (1H, bs, NH) 10.1 (1H, s, NH).

Anal. Calcd. for $C_{14}H_{16}N_2O_2S$: C, 60.87; H, 5.80; N, 10.15%. Found: C, 61.00; H, 5.91; N, 10.18%.

Ethyl-6-methyl-4-[4-(N, N-dimethylamino)phenyl]-2-oxo-1,2,3,4-tetrahydropyrimidine-5-carboxylate (4c).

This compound was prepared by mixing of 4-N, N-dimethylaminobenzaldehyde **(1c)** (1.86 g, 0.0125 mole), urea **(2a)** (0.75 g, 0.0125 mole), ethyl acetoacetate **(3)** (1.89 mL, 0.015 mole) and two drops of concentrated hydrochloric acid.

Power level = 100%, time of reaction: 30 seconds. mp 248–250 °C, (2.69 g, 71%). IR (KBr): 3240, 3100 (NH), 3050–2800 (CH aromatic, olefinic and aliphatic), 1730, 1700 (C=O), 1640 (C=C olefin), 1610, 1520 (C=C aromatic), 1220, 1080 (C—O ester) cm^{-1}; ^{1}H-nmr (DMSO-d_6): δ 1.1 (3H, t, J = 7.2 Hz, CH_3), 2.2 (3H, s, CH_3), 2.8 (6H, s, N $(CH_3)_2$), 4.0 (2H, q, J = 7.2 Hz, CH_2), 5.0 (1H, d, J = 2.4 Hz, H-4), 6.5–7.1 (4H, m, aromatic protons), 7.5 (1H, bs, NH), 9.0 (1H, s, NH); ^{13}C-nmr (DMSO-d_6): δ 13, 17 (CH_3), 39.5 ($N(CH_3)_2$), 52 (CH), 58 (CH_2), 98, 111, 126, 132, 146, 149, 151 (aromatic and olefinic), 165, 201 (C=O); ms (70 eV): m/z (%) = 303 (M^+, 2), 230 (53), 183 (12), 120 (100).

Anal. Calcd. for $C_{16}H_{21}N_3O_3$: C, 63.35; H, 6.98; N, 13.85%. Found: C, 63.51; H, 7.00; N, 13.74%.

Ethyl-4-(4-acetamidophenyl)-6-methyl-2-thioxo-1,2,3,4-tetrahydropyrimidine-5-carboxylate (4d).

This compound was prepared by mixing of 4-acetamidobenzaldehyde **(1d)** (0.82 g, 0.005 mole), thiourea **(2b)** (0.38 g, 0.05 mole), ethyl acetoacetate **(3)** (0.76 mL, 0.006 mole) and one drop of concentrated hydrochloric acid.

Power level = 100%, time of reaction: 20 seconds. mp 273–274 °C, (1.25 g, 75%), IR (KBr): 3300, 3240 (NH), 3100–2900 (CH aromatic, olefinic and aliphatic), 1700, 1660 (C=O), 1200, 1120 (C—O ester) cm^{-1}; ^{1}H-nmr (DMSO-d_6): δ 1.0 (3H, t, J = 7.2 Hz, CH_3), 1.9, 2.2 (3H, s, CH_3), 4.0 (2H, q, J = 7.2 Hz, CH_2), 5.1 (1H, d, J = 3.6 Hz, H-4), 7.0–7.6 (4H, m, aromatic protons), 9.5 (1H, bs, NH), 10.3 (1H, s, NH); ^{13}C-nmr (DMSO-d_6): δ 13, 16, 23 (CH_3), 53(CH), 59(CH_2), 100, 118, 126, 137, 138, 144 (aromatic and olefin), 164 (C=S), 167, 174 (C=O); ms (70 eV): m/z (%) = (M^+, 5), 260 (24), 216 (48), 199 (43).

Anal. Calcd. for $C_{15}H_{18}N_3O_4S$: C, 57.60; H, 5.74; N, 12.60%. Found: C, 57.35; H, 5.84; N, 12.47%.

Ethyl-4-[(2-chloro-6-fluoro) phenyl]-6-methyl-2-thioxo-1,2,3,4-tetrahydro-pyrimidine-5-carboxylate (4e).

This compound was prepared by mixing of (2-chloro-6-fluoro)benzaldehyde (1e) (0.50 g, 3.125×10^{-3} mole), thiourea (2b) (0.24 g, 3.125×10^{-3} mole), ethyl acetoacetate (3) (0.48 mL, 3.75×10^{-3} mole) and containing one drop of concentrated hydrochloric acid.

Power level = 10%, time of reaction: 40 minutes. mp 186–187 °C, (0.66 g, 64%), IR (KBr): 3170, 3100 (NH), 3050–2900 (CH aromatic, olefinic and aliphatic), 1713, 1653 (C=O), 1593 (C=C olefin), 1493, 1456 (C=C aromatic), 1190, 1103 (C—O ester) cm^{-1}, ^{1}H-nmr (DMSO-d_6): δ 1.2 (3H, t, J = 7.2 Hz, CH_3), 2.1 (3H, s, CH_3), 3.9 (2H, q, J = 7.2 Hz, CH_2), 5.8 (1H, d, J = 2.4 Hz, H-4), 7.2 (3H, m, aromatic protons), 9.4 (1H, bs, NH), 10.3 (1H, s, NH); ms (70 eV): m/z (%) = 327 (M^+, 10), 299 (22), 255 (17), 199 (38), 42 (100).

Anal. Calcd. for $C_{14}H_{14}N_2O_2$ SClF: C, 51.15; H, 4.26; N, 8.52%. Found: C, 51.19; H, 4.37; N, 8.25%.

Ethyl-4-(4-chlorophenyl)-6-methyl-2-oxo-1,2,3,4-tetrahydropyrimidine-5-carboxylate (4f).

A reaction mixture of 4-chlorobenzaldehyde **(1f)** (0.70 g, 0.005 mole), urea **(2a)** (0.30 g, 0.005 mole), ethyl acetoacetate **(3)** (0.95 mL, 0.0075 mole) and one drop of concentrated hydrochloric acid was taken in a pyrex beaker and irradiated in an unmodified household microwave oven at 100% power level for 40 seconds. The mixture then was allowed to cool and solid product was filtered, washed with ethanol and water (1 : 1) and dried. White crystals were recrystaized mp 214–215

°C, (1.13 g, 77%), IR (KBr): 3242, 3118 (NH), 3050–2900 (CH aromatic, olefinic and aliphatic), 1725, 1702 (C=O), 1648 (C=C olefin), 1570, 1490 (C=C aromatic), 1221, 1088 (C—O ester) cm^{-1}; ^{1}H-nmr (DMSO-d_6): δ 1.0 (3H, t, J = 7.2 Hz, CH_3), 2.0 (3H, s, CH_3), 3.9 (2H, q, J = 7.2 Hz, CH_2), 4.8 (1H, d, J = 2.4 Hz, H-4), 7.0–7.3 (4H, m, aromatic protons), 7.6 (1H, bs, NH), 9.0 (1H, s, NH); ^{13}C-nmr (DMSO-d_6): δ 14, 18 (CH_3), 53 (CH), 59 (CH_2), 99, 128, 128.3, 132, 144, 149 (aromatic and olefin), 151, 165 (C=O); ms (70 eV): m/z (%) = 294 (M^+, 24), 279 (3), 249 (9), 183 (100).

Anal. Calcd. for $C_{14}H_{15}N_2O_3Cl$: C, 57.14; H, 5.10; N, 9.57%. Found: C, 57.09; H, 4.96; N, 9.37%.

Ethyl-4-(4-chlorophenyl)-6-methyl-2-thioxo-1,2,3,4-tetrahydropyrimidine-5-carboxylate (4g)

A reaction mixture of 4-chlorobenzaldehyde **(1g)** (0.70 g, 0.005 mole), thiourea **(2b)** (0.38 g, 0.005 mole), ethyl acetoacetate **(3)** (0.95 mL, 0.0075 mole) and one drop of concentrated hydrochloric acid was taken in a pyrex beaker and irradiated in an unmodified household microwave oven at 100% power level for 50 seconds. The jelly product poured in 30 mL of ice-water and stirred for 15 minutes, then water from jelly product was separated, and remained until soild was formed. The solid was recrystalized by ethanol and dried. mp 189–190 °C (0.911 g, 66%), IR (KBr): 3329, 3175 (NH), 3105–2900 (CH aromatic, olefinic and aliphatic), 1673 (C=O), 1197, 1119 (C—O ester) cm^{-1}; ^{1}H-nmr (DMSO-d_6): δ 1.1 (3H, t, J = 7.2 Hz, CH_3), 2.3 (3H, s, CH_3), 4.0 (2H, q, J = 7.2 Hz, CH_2), 5.1 (1H, d, J = 2.4 Hz, H-4), 7.2–7.5 (4H, m, aromatic protons), 9.7 (1H, bs, NH), 10.4 (1H, s, NH); ^{13}C-nmr (DMSO-d_6): δ 14, 17 (CH_3), 53 (CH), 60 (CH_2), 100, 128.2, 128.5, 132, 142, 145 (aromatic and olefin), 165 (C=S), 174 (C=O); mass (70 eV): m/z (%) = 310 (M^+; 28), 281 (19), 265 (6), 239 (100), 199 (37).

Anal. Calcd. for $C_{14}H_{15}N_2O_2SCl$: C, 57.10; H, 4.83; N, 9.01%. Found: C, 56.97; H, 4.47; N, 9.14%.

Ethyl-4-(3,4-dimethoxyphenyl)-6-methyl-2-oxo-1,2,3,4-tetrahydropyrimidine-5-carboxylate (4h)

A reaction mixture of 3,4-dimethoxybenzaldehyde **(1h)** (0.42 g, 0.0025 mole), thiourea **(2a)** (0.18 g, 0.003 mole), ethyl acetoacetate **(3)** (0.32 mL, 0.0025 mol) and one drop of cocentrated hydrochloric acid was taken in a pyrex beaker .

Power level = 10%, time of reaction: 17 min. mp 183–185 °C (0.54 g, 67%), IR (KBr): 3248, 3119 (NH), 3080–2900 (CH aromatic, olefinic and aliphatic), 1722, 1700 (C=O), 1665 (C=C olefin), 1282–1028 (C—O ester and ether) cm^{-1}; ^{1}H-nmr (DMSO-d_6): δ 1.0 (3H, t, J = 7.2 Hz, CH_3), 2.1 (3H, s, CH_3), 3.6 (6H, s, OCH_3), 3.9 (2H, q, J = 7.2 Hz, CH_2), 5.0 (1H, d, J = 3.6 Hz, H-4), 6.6–6.8 (3H, m, aromatic protons), 7.5 (1H, bs, NH), 9.0 (1H, s, NH); ^{13}C-nmr (DMSO-d_6): δ 14, 18 (CH_3), 53 (CH), 55.4, 55.5 (OCH_3), 59 (CH_2), 99, 111, 112, 118, 137, 148, 149 (aromatic and olefin), 152, 165 (C=O).

Anal. Calcd. for $C_{16}H_{20}N_2O_5$: C, 58.45; H, 6.49; N, 9.09%. Found: C, 58.79; H, 6.39; N, 8.75%.

Ethyl-6-methyl-4-[(4-N, N-dimethylamino)phenyl]-2-thioxo-1,2,3,4-tetrahydropyrimidine-5-carboxylate (4i).

A ternary mixture of 4-(N, N-dimethylamino)benzaldehyde **(1c)** (1.24 g, 0.0083 mole), ethyl acetoacetate (1.10 mL, 0.0083 mole) and thiourea **(2b)** (0.76 g, 0.01 mole) in ethanol (4 mL) containing a catalytic amount of concentrated hydrochloric acid (3 drops) was refluxed for 3 h. The reaction mixture was then allowed to stand at room temperature overnight, whereby the solid precipitate so formed was collected by filtration, washed, with ethanol and crystalized from ethanol. mp 198–199 °C (2.07 g, 78%), IR (KBr): 3330, 3160 (NH), 3100–2920 (CH aromatic, olefinic and aliphatic), 1720 (C=O) cm^{-1}; The ^{1}H-nmr (DMSO-d_6): δ 1.2 (3H, t, J = 7.2 Hz, CH_3), 2.3 (3H, s, CH_3), 2.9 (6H, s, $N(CH_3)_2$), 4.0 (2H, q, J = 7.2 Hz, CH_2), 5.1 (1H, d, J = 2.4 Hz, H-4), 6.6–7.2 (4H, m, aromatic protons), 9.3 (1H, bs, NH), 10.2 (1H, s, NH).

Ethyl-4-(4-hydroxyphenyl)-6-methyl-2-thioxo-1,2,3,4-tetrahydropyrimidine-5-carboxylate (4j).

A ternary mixture of 4-hydroxybenzaldehyde **(1j)** (3.66 g, 0.03 mole), ethyl acetoacetate **(3)**, (3.80 mL, 0.03 mole) and thiourea **(2b)** (3.04 g, 0.04 mole) in ethanol (15 mL) containing a catalytic amount of concentrated hydrochloric acid (5 drops) was refluxed for 4.5 h. The reaction mixture was then allowed to stand at room temperature 2 days, where by the white solid precipitate so formed was collected by filtration, washed, with cyclohexane and crystalized from ethanol. mp 158–159°C (5.96 g, 68%), IR (KBr): 3400, 3170 (NH), 3080–2950 (CH aromatic, olefinic and aliphatic); ^{1}H-nmr (DMSO-d_6): 1.1 (3H, t, J = 7.2 Hz, CH_3), 2.3 (3H, s, CH_3), 4.0 (2H, q, J = 7.2 Hz, CH_2), 5.1 (1H, d, J = 2.4 Hz, H-4), 6.8–7.2 (5H, m, aromatic protons and OH phenol), 9.3 (1H, bs, NH), 10.0 (1H, s, NH).

5-Acyl-4-(4-chlorophenyl)-2-oxo-1,2,3,4-tetrahydropyrimidine (6a).

This compound was prepared by mixing of 4-chlorobenzaldehyde **(1f)** (0.70 g, 0.005 mole), acetylacetone **(5)** (0.78 mL, 0.0075 mole), urea **(2a)** (0.30 g, 0.005 mole) and one drop concentrated hydrochloric acid. The reaction mixture was taken in a pyrex beaker and irradiated in a microwave oven at 100% power level for 40 seconds. The brown liquid was obtained, allowed to cool at room temperature and changed to solid state. The solid was filtered, washed by ethanol and amyl alcohol (1 : 2) and dried. The white precipitate was obtained. mp 222–224 °C, (0.81 g, 61%), IR (KBr): 3290, 3122 (NH), 3050–2900 (CH aromatic, olefinic and aliphatic), 1699, 1619 (C=O) cm^{-1}; ^{1}H-nmr (DMSO-d_6): δ 1.9, 2.1 (3H, s, CH_3), 5.1 (1H, d, J = 2.4 Hz, H-4), 7.0–7.2 (4H, 4 m, aromatic protons), 7.6 (1H, bs, NH), 9.0 (1H, s, NH); ^{13}C-nmr (DMSO-d_6): δ 19, 30 (CH_3), 53 (CH), 109, 128, 131, 141 (aromatic and olefin), 153, 194 (C=O); mass (70 eV): m/z (%) = 254 (M^+, 58), 249 (34), 221 (30), 153 (100), 43 (63).

5-Acyl-4-(4-chlorophenyl)-6-methyl-2-thioxo-1,2,3,4-tetrahydropyrimidine (6b).

This compound was prepared by mixing of 4-chlorobenzaldehyde **(1g)** (0.70 g, 0.005 mole), acetylacetone **(5)** (0.78 g, 0.0075 mole), thiourea **(2b)** (0.38 g, 0.005 mole) and one drop concentrated hydrochloric acid under the irradiation in a microwave oven at 100% power level for 30 s. The brown liquid was allowed to cool at room temperature and changed to solid state . The solid was filtered, washed by ethanol and amyl alcohol (1 : 2) and dried. The clear brown precipitate was obtained mp 224.5–226.5 °C, (0.94 g, 76%), IR (MBr): 3283, 3182 (NH), 3100–2900 (CH aromatic, olefinic and aliphatic), 1621 (C=O), 1572 (C=C olefin), 1590, 1490 (C=C aromatic) cm^{-1}; The ^{1}H-nmr (DMSO-d_6): δ 2.0, 2.1 (3H, s, CH_3), 5.1 (1H, d, J = 3.6 Hz, H-4), 7.0–7.3 (4H, m, aromatic protons), 9.6 (1H, bs, NH), 10.0 (1H, s, NH); ^{13}C-nmr (DMSO-d_6): δ 18, 30 (CH_3), 53 (CH), 110, 128, 128.5, 132, 142, 145 (aromatic and olefin), 174 (C=S), 195 (C=O); mass (70 eV): m/z (%) = 280 (M^+, 100), 265 (25), 237 (32), 169 (68), 43 (75).

Anal. Calcd. for $C_{13}H_{13}N_2OSCl$: C, 55.42; H, 4.62; N, 9.95%. Found : C, 55.49; H, 4.67; N, 9.87%.

5-Acyl-4-(3,4-dimethoxyphenyl)-6-methyl-2-thioxo-1,2,3,4-tetrahydropyrimidine (6c).

This compound was prepared by mixing of 3,4-dimethoxybenzaldehyde **(1h)** (0.415 g, 0.0025 mole), acetylacetone **(5)** (0.26 mL, 0.0025 mole), thiourea **(2b)** (0.228 g, 0.003 mole) and one drop concentrated hydrochloric acid under the irradiation of a microwave oven at 10% power level for 15 min. The red solid was obtained, dissolved in minimum volume of ethanol to obtain desired product. mp 180–182 °C, (0.383 g, 50%), IR (KBr): 3248, 3119 (NH), 3100–2900 (CH aromatic, olefinic and aliphatic), 1723 (C=O), 1028–1323 (C—O ether) cm^{-1}; ^{1}H-nmr (DMSO-d_6): δ 2.1, 2.3 (3H, s, CH_3), 3.8 (6H, s, OCH_3), 5.3 (1H, d, J = 3.6 Hz, H-4), 6.6–7.4 (3H, m, aromatic protons), 9.6 (1H, bs, NH), 10.2 (1H, s, NH).

Anal. Calcd. for $C_{15}H_{18}N_2O_3S$: C, 58.82; H, 5.88; N, 9.15%. Found: C, 59.00; H, 5.91; N, 9.19%.

Antimicrobial studies (antimicrobial activity)

All the compounds were tested against pathogenicbacteria for their antimicrobial activity using serial dilution method against two bacteria. The products were screened for antibacterial activity by broth dilution in basic culture (Muller Hinton broth).[10]

Microorganisms employed were *Staphylocucus auerus* and *Escherichia coli* using DMSO as a solvent at a concentration 256 μg/mL. The results (Table-1) show that these compounds have some influence on the gram positive bacteria and they can stop the growth of this group of bacteria.

TABLE-1
ANTIMICROBIAL ACTIVITY OF COMPOUNDS

S.No.	Compound	(MIC) μg/mL	
		E. coli	S. auerus
1.	**4a**	16.00	–
2.	**4b**	8.00	–
3.	**4c**	0.12	–
4.	**4g**	16.00	–
5.	**4i**	0.50	–
6.	**4j**	0.50	–

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