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Note

Synthesis of some novel chalcones of phthalimidoester possessing good anti-inflammatory and antimicrobial activity

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A new series of methyl-2-[substituted benzylidine]-4-[2-(phthalimide) ethoxy] acetoacetate, **5a-h** have been synthesized from the combination of methyl-4-[2-(phthalimido) ethoxy] acetoacetate, **3** and substituted benzaldehyde **4a-h** which results in both anti-inflammatory and antimicrobial active compound. These compounds have been characterized by IR, ^{1}H NMR, mass spectral and elemental analysis. These compounds have been subjected to preliminary anti-inflammatory screening using the carrageenan induced rat pow oedema model. Compounds **5a,b,c** show marked activity comparable to indomethacin. Compounds **5a,b,c,g** show significant antimicrobial activity.

Keywords: Ester of phthalimides, chalcones, anti-inflammatory and antimicrobial activity

Chalcones are well known intermediates for synthesizing various heterocyclic compounds. Chalcones, either natural or synthetic, are known to exhibit various biological activities[1]. The pharmaceutical importance of these lies in the fact that they can be effectively utilized as antibacterial[2], antiplatelet[3], antiulcerative[4], antimalarial[5], anticancer[6], antiviral[7], antileishmanial[8], antioxidant[9], antitubercular[10], antihyperglycemic[1], immunomodulator[11], inhibition of chemical mediators release[12], inhibition of leukotrieneB$_4$ (ref. 13), inhibition of tyrosinase[14], inhibition of aldose reductase[15] activity. Some of these compounds are also known to possess anti-inflammatory[16] and analgesic[17] properties. In view of the diverse type of biological activities it was thought worthwhile to focused on this class of compounds. Syntheses of chalcones have been reported by the action of appropriate acetophenones with appropriate aromatic aldehyde in the presence of aqueous solution of potassium hydroxide and ethanol at room temperature by Claisen-Schmidt condensation method. In the present communication we report a new series of chalcones of phthalimidoester **5a-h** which are obtained by condensing methyl-4-[2-(phthalimido) ethoxy] acetoacetate with various substituted benzaldehydes in presence of piperidine and acetic acid by using alcohol as solvent. The structures of various synthesized compounds were assigned on the basis of IR, ^{1}H NMR spectral data and elemental analysis. Further studies, these compounds were subjected for anti-inflammatory and antimicrobial activity.

The *in vivo* anti-inflammatory activity of the synthesized compounds **5a-h** (**Table I**) was evaluated by Carrageenan induced paw oedma in rats taking Carrageenan as control and indomethacin as standard.

The *in vitro* antibacterial (*Escherichia coli, Salmonella typhi, Staphylococcus aureus* and *Bacillus subtilis*) and antifungal (*Aspergillus niger, Aspergillus flavus, Penicillium chrysogenum* and *Fusurium moneliforme*) activity of the compounds were evaluated by paper disc diffusion method. The minimum inhibitory concentrations (MIC) of the compounds were also determined by agar streak dilution method **Tables II** and **III**.

Result and Discussion

In the present study, series of chalcones of phthalimidoester **5a-h** were prepared by condensing various substituted benzaldehyde **4a-h** with methyl-4-[2-(phthalimido) ethoxy] acetoacetate **3,** using piperidine, acetic acid and methanol as solvent **(Scheme I)**. This procedure afforded various chalcones in good yields possessing potent anti-inflammatory and antimicrobial activity.

All the compounds exhibited significant anti-inflammatory activity. Among the eight compounds **5a, 5b** and **5c** at 200 mg/kg (p.o.) showed significant reduction in paw oedema, when compared to other compounds. The compounds **5b** showed 70% protection, compound **5a** and **5c** showed 67.50%, compounds **5d, 5e** and **5h** showed 60% and compounds **5f** and **5g** showed 55% protection. The standard indomethacin showed 75% protection. The compound did not cause mortality up to 2000 mg/kg in acute oral toxicity studied (OECD-423 guidelines) and were considered as safe (X-unclassified).

Table I — Anti-inflammatory activity of the synthesized compounds **5a-h**

Compd		1hr	2hr	3hr	4hr	5hr
Control 1%	CMC (1mL/kg)	0.16±0.003	0.22±0.006	0.30±0.005	0.35±0.004	0.40±0.005
5a	(200mg/kg)	0.15±0.003**	0.18±0.007**	0.20±0.003**	0.17±0.005***	0.13±0.006***
		(6.25%)	(18.18%)	(33.33%)	(51.42%)	(67.50%)
5b	(200mg/kg)	0.15±0.004**	0.17±0.004**	0.18±0.004***	0.16±0.006***	0.12±0.004***
		(6.25%)	(22.72%)	(40.00%)	(54.28%)	(70.00%)
5c	(200mg/kg)	0.13±0.002**	0.19±0.003**	0.17±0.003***	0.14±0.004***	0.13±0.004***
		(18.75%)	(13.63%)	(43.00%)	(60.00%)	(67.50%)
5d	(200mg/kg)	0.13±0.004**	0.17±0.004**	0.16±0.003***	0.17±0.003***	0.16±0.003***
		(18.75%)	(22.72%)	(46.00%)	(51.42%)	(60.00%)
5e	(200mg/kg)	0.14±0.003**	0.18±0.007**	0.17±0.004***	0.15±0.004***	0.16±0.003***
		(12.50%)	(18.18%)	(43.00%)	(57.14%)	(60.00%)
5f	(200mg/kg)	0.15±0.003**	0.19±0.003**	0.17±0.003***	0.14±0.004***	0.18±0.004***
		(06.25%)	(13.63%)	(43.00%)	(60.00%)	(55.00%)
5g	(200mg/kg)	0.14±0.004**	0.17±0.003**	0.20±0.004***	0.18±0.004***	0.18±0.004***
		(12.50%)	(22.72%)	(33.33%)	(48.00%)	(55.00%)
5h	(200mg/kg)	0.15±0.003**	0.17±0.005**	0.18±0.003***	0.16±0.005***	0.16±0.003***
		(06.25%)	(22.72%)	(40.00%)	(54.28%)	(60.00%)
Standard Indomethacin	(20mg/kg)	0.15±0.002**	0.16±0.007**	0.15±0.005***	0.12±0.003***	0.10±0.002***
		(06.25%)	(27.27%)	(50.00%)	(65.71%)	(75.00%)

All values are mean ± SEM values using 6 animals in each group. Significant differences with respect to control groups was evaluated by ANOVA, Dannets 't' test. *P<0.05, **P<0.01, ***P<0.001.

$$\text{Percentage protection} = \frac{\text{Control - test}}{\text{Control}} \times 100$$

Table II — Antibacterial screening results of the compounds **5a-h**

Compd	Antibacterial activity (Inhibition zone in mm)			
	E. coli	*Salmonella typhi*	*Staphylococcus aureus*	*Bacillius Subtilis*
5a	13	15	25	13
5b	15	20	30	18
5c	14	18	23	16
5d	12	14	18	16
5e	12	11	14	15
5f	-ve	-ve	-ve	-ve
5g	11	14	25	12
5h	11	13	14	12
Penicillin	18	25	40	27
DMSO	-ve	-ve	-ve	-ve

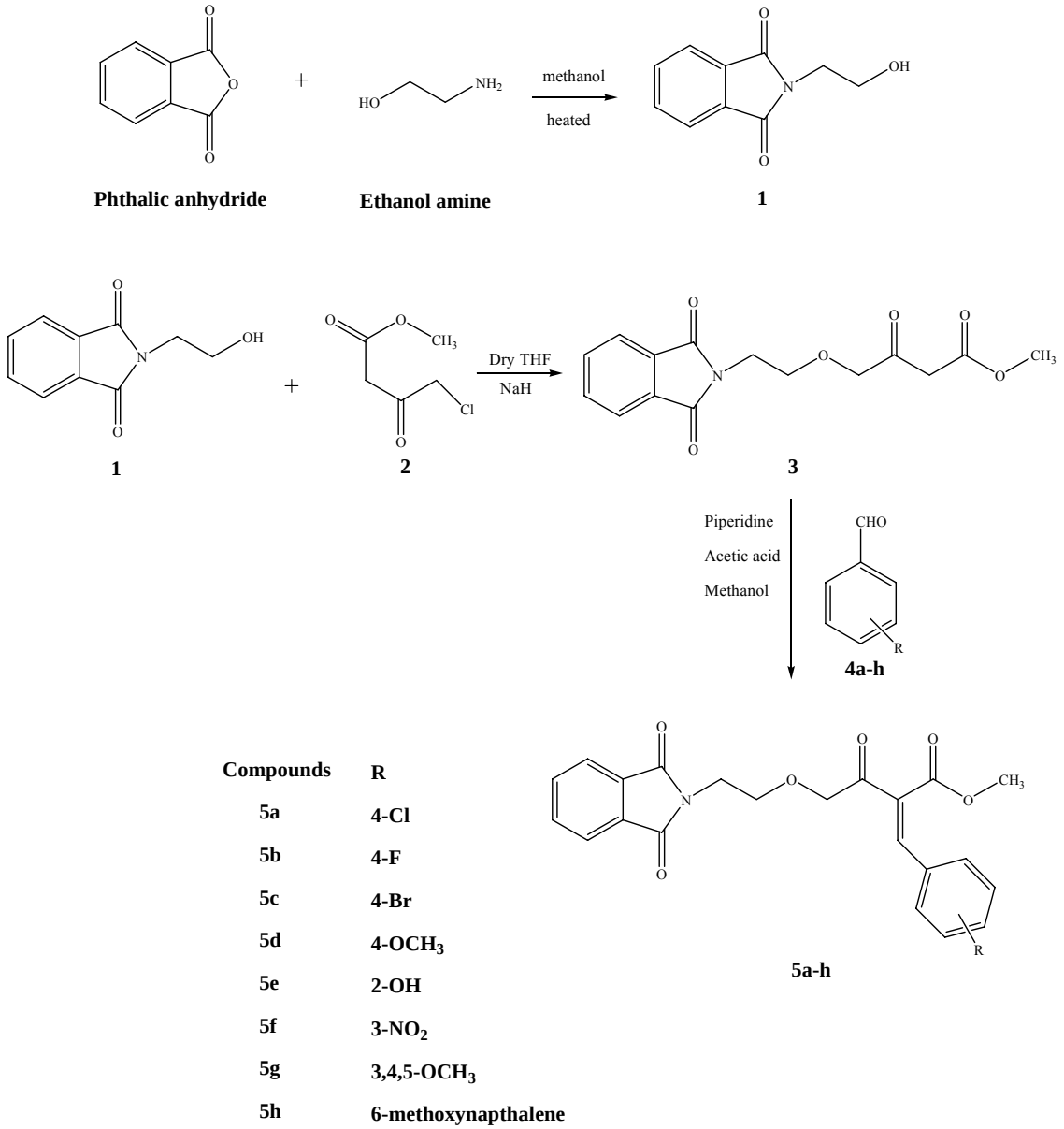
-ve No antibacterial activity

Table III — Antifungal screening results of the compounds **5a-h**

Compd	Antifungal activity			
	Aspergillus niger	*Aspergillus flavus*	*Penicillium chrysogenum*	*Fusarium moneliforme*
5a	-ve	-ve	-ve	+ve
5b	-ve	-ve	-ve	-ve
5c	-ve	-ve	-ve	+ve
5d	-ve	-ve	+ve	-ve
5e	-ve	+ve	+ve	-ve
5f	+ve	+ve	-ve	+ve
5g	-ve	-ve	+ve	+ve
5h	-ve	-ve	+ve	+ve
Greseofulvin	-ve	-ve	-ve	-ve
Control	+ve	+ve	+ve	+ve

+ve - Growth: No Antifungal activity
-ve - No growth: Antifungal activity observed

The investigation of antibacterial screening data revealed that all the tested compounds showed moderate to good bacterial inhibition zone. In particular compounds **5b** and **5c** showed higher activity against all the bacteria, compounds **5a, 5d** and **5e** shows moderate activity against all the bacteria, while **5g** and **5h** shows mild activity against all the bacteria but compound **5f** does not show any activity against all the bacteria. The investigation of antifungal activity data revealed that the compounds



Compounds	R
5a	4-Cl
5b	4-F
5c	4-Br
5d	4-OCH_3
5e	2-OH
5f	3-NO_2
5g	3,4,5-OCH_3
5h	6-methoxynapthalene

Scheme I

5a, 5b and **5c** shows inhibitory effect against *Aspergillus niger, Aspergillus flavus, Penicillium chrysogenum,* from the remaining compounds most of them shows inhibitory effect against *Aspergillus niger, Aspergillus flavus, Penicillium chrysogenum,* while **5a, 5c, 5f, 5g** and **5h** are inactive against Fusurium moneliforme. Among the compounds **5a, 5b** and **5c** showed potent antimicrobial activity.

Experimental Section

^{1}H NMR spectra were recorded on 400 MHz Bruker DPX 200 spectrophotometer in DMSO using TMS as internal standard (chemical shift in δ ppm). The IR spectra of the compounds were recorded on ABB Bomem FTIR spectrophotometer MB 104 in KBr pellets. Mass spectra were recorded on a Shimadzu QP 5000 GC-MS. Microanalysis for C, H, and N were performed in Heraeus CHN Rapid Analyzer. All the compounds gave satisfactory chemical analysis (± 0.4%). The homogeneity of the compounds was checked by TLC on aluminium foil backed precoated SiO_2 gel (HF 254, 200 mesh) plates (E Merck) using ethyl acetate/hexane as mobile phase and visualized by iodine vapours or by irradiation with ultraviolet lights (254nm).

Synthesis of *N*-(2-hydroxyethyl) phthalimide 1

A two necked flask (100 mL), equipped with a magnetic stirring bar and thermometer was charged with 20 g (135 mmoles) of phthalic anhydride and 9.1 g (148.5 mmoles) of ethanol amine. The mixture was heated from 115 to 125ºC in 20min and then stirred at 125°C for an additional 10 min the resulting light yellow solution was cooled to 50ºC and then 50 mL methanol was added. While cooling the reaction mixture to RT, the product was precipitated out and 50 mL of water was added and the resulting mixture was vigorously stirred for 10 min and then the product was filtered off to give 18.80 g of *N*-(2-hydroxyethyl) phthalimide as a white solid product. The methanolic aqueous layer was extracted with 80 mL of ethyl acetate. After separating the phases, the organic phase dried over 3 g of $MgSO_4$. $MgSO_4$ was filtered of and the filtrate was concentrated in vacuo to give 1.65 g of white solid product which was combined with 18.8 g of product.

Mol. formula $C_{10}H_9NO_3$ Yield: 77%. m.p. 128ºC. ^{1}H NMR ($CDCl_3$): δ 7.79 (dd, 2H, J = 8 Hz, Ar-H), 7.68 (dd, 2H, J = 8.1 Hz, Ar-H), 3.84 (t, 4H, CH_2), 2.70 (br, 1H, OH); ^{13}C NMR ($CDCl_3$): δ 169.2, 134.5, 132.2, 123.5, 61.2, 40.5; IR (KBr): 3467, 1683 cm^{-1}; MS: *m/z* 192 (M+1). Anal. Calcd C, 62.82; H, 4.74; N, 7.33. Found: C, 62.50; H, 4.50; N, 7.00%.

Synthesis of methyl-4-[2-(phthalimido) ethoxy] acetoacetate 3

A two-necked flask (250 mL), equipped with a magnetic stirring bar, thermometer and a pressure equalized addition funnel was charged with 60 mL of tetrahydrofuran under nitrogen atmosphere. Sodium hydride (3.14 g, 0.13 mole) (60% dispersed in oil) was added and the resulting suspension was cooled to –10ºC and (10 g, 0.05 mole) of *N*-(2-hydroxyethyl) phthalimide was added slowly over 5 min. The resulting slurry was stirred at –10ºC for 30 min. To this mixture a solution of (7.48 g, 0.05 mole) methyl-4-chloroacetoactate in 25 mL of tetrahydrofuran was added at –10ºC in 40 min. The reaction mixture was warmed to room temperature and then stirred at room temperature for 5 hr. The reaction mixture was placed in ice bath and quenched by drop wise addition of 5 mL ethanol. The reaction mixture was then poured into 100 mL of 1N HCl solution in crushed ice and ethyl acetate (150 mL) was added. The resulting mixture was transferred into a separating funnel and the aqueous phase was separated. The organic phase was first washed with 5% $NaHCO_3$ solution, then with 100 mL of water, dried over 5 g $MgSO_4$. $MgSO_4$ was filtered off and the filtrate was concentrated in vacuo to give a light brown oily product. The oil was washed with 10 mL of hexane to remove the mineral oil to give 8.87 g of methyl-4-[2-(phthalimido) ethoxy] acetoacetate as a light brown oily product.

Mol. formula $C_{15}H_{15}NO_6$ Yield: 8.87 g (55%); ^{1}H NMR (DMSO-d_6): δ 7.58-7.54 (dd, 2H, J = 7.8 Hz, Ar-H), 7.80-7.66(dd, 2H, J = 7.8 Hz, Ar-H), 4.17 (s, 2H, -O-CH_2-C=O), 3.73-3.71 (t, 2H, J = 8.2 Hz, -O-CH_2), 3.65-3.62 (t, 2H, J = 8 Hz, -N-CH_2), 3.54 (s, 3H, -OCH_3), 3.48(s, 2H, O=C-CH_2-C=O); IR (KBr): 2990, 1715 cm^{-1}; MS: *m/z* 306 (M+1). Anal. Calcd C, 59.01; H, 4.95; N, 4.59. Found: C, 58.85; H, 4.65; N, 58.79%.

General method for synthesis of methyl-2-[substituted benzylidine]-4-[2-(phthalimide) ethoxy]acetoacetate 5a-h

A two-necked flask (250 mL), equipped with a magnetic stirring bar and thermometer was charged with (10 g, 0.03 mole) of **3** (methyl-4-[2-(phthalimido) ethoxy] acetoacetate) and substituted benzaldehyde (0.03 mole) and 100 mL methanol under nitrogen atmosphere. To the resulting mixture was added 0.188 mL acetic acid and 0.223 mL piperidine. The reaction mixture was heated to 37°C and stirred at this temperature for 5 hr. The solvent was removed *in vacuo* and the residue was dissolved in 100 mL of methylene chloride. The resulting solution was washed with 100 mL of sat. $NaHCO_3$ and 100 mL of water and dried over 5 g of $MgSO_4$. $MgSO_4$ was filtered and the filtrate was concentrated *in vacuo*. The residue was purified by column chromatography using ethyl acetate/hexane (20/80) as an eluent to give 75% of the title compounds **5a-h** as light yellow oil.

Methyl-2-[4-chlorobenzylidine]-4-[2-(phthalimide)-ethoxy]acetoacetate 5a

Mol. formula $C_{22}H_{18}ClNO_6$, light yellow oil, Yield: 10.50 g (75%): ^{1}H NMR (DMSO-d_6): δ 7.86(s,1H, -CH), 7.85-7.78(m, 4H, Ar-H), 7.45-7.38 (dd, 2H, J = 8.4 Hz, Ar-H), 7.36-7.28(dd, 2H, J = 8.4 Hz, Ar-H), 4.27 (s, 2H, -O-CH_2-C=O), 3.80-3.76 (t, 2H, J = 7.2 Hz, -O-CH_2), 3.73-3.70 (t, 2H, J = 7.2 Hz, -N-CH_2), 3.66 (s,3H, -OCH_3); IR (KBr): 2855, 1765, 1680, 754 cm^{-1}; MS: *m/z* 428 (M+1). Anal. Calcd C, 61.50; H, 4.24; N, 3.27. Found: C, 61.50; H, 4.00; N, 3.15%.

Methyl-2-[4-fluorobenzylidine]-4-[2-(phthalimide)-ethoxy]acetoacetate 5b

Mol. formula $C_{22}H_{18}FNO_6$, light yellow oil, Yield: 10.78g (80%): ^{1}H NMR (DMSO-d_6): δ 7.85(s,1H, -CH), 7.84-7.77(m, 4H, Ar-H), 7.41-7.35 (dd, 2H, *J* = 8.4 Hz, Ar-H), 7.32-7.26(dd, 2H, *J* = 8.4 Hz, Ar-H), 4.29 (s, 2H, -O-CH_2-C=O), 3.78-3.76 (t, 2H, *J* = 8 Hz, -O-CH_2), 3.75-3.69 (t, 2H, *J* = 8 Hz, -N-CH_2), 3.66 (s,3H, -OCH_3); IR (KBr): 2857, 1763, 1685, 760 cm^{-1}; MS: *m/z* 412 (M+1). Anal. Calcd C, 64.23; H, 4.41; N, 3.40. Found: C, 64.00; H, 4.30; N, 3.25%.

Methyl-2-[4-bromobenzylidine]-4-[2-(phthalimide)-ethoxy]acetoacetate 5c

Mol. formula $C_{22}H_{18}BrNO_6$, light yellow oil, Yield: 11.89g (77%): ^{1}H NMR (DMSO-d_6): δ 7.83(s,1H, -CH), 7.86-7.75(m, 4H, Ar-H), 7.38-7.25 (dd, 2H, *J* = 8.6 Hz, Ar-H), 7.00-6.98(dd, 2H, *J* = 8.8 Hz, Ar-H), 4.26 (s, 2H, -O-CH_2-C=O), 3.76-3.73 (t, 2H, *J* = 7 Hz, -O-CH_2), 3.74-3.70 (t, 2H, *J* = 7.1 Hz, -N-CH_2), 3.65 (s,3H, -OCH_3); IR (KBr): 2854, 1760, 1680, 750 cm^{-1}; MS: *m/z* 473 (M+1). Anal. Calcd C, 55.95; H, 3.84; N, 2.97. Found: C, 55.50; H, 3.65; N, 2.70%.

Methyl-2-[4-methoxybenzylidine]-4-[2-(phthalimide)ethoxy]acetoacetate 5d

Mol. formula $C_{23}H_{21}NO_7$, light yellow oil, Yield: 10.26g (74%): ^{1}H NMR (DMSO-d_6): δ 7.81(s,1H, -CH), 7.80-7.78(m, 4H, Ar-H), 7.36-7.28 (dd, 2H, *J* = 8.1 Hz, Ar-H), 6.98-6.90(dd, 2H, *J* = 8.4 Hz, Ar-H), 4.27 (s, 2H, -O-CH_2-C=O), 3.76 (s,3H, -OCH_3), 3.75-3.72 (t, 2H, *J* = 7.8 Hz, -O-CH_2), 3.72-3.67 (t, 2H, *J* = 7.8 Hz, -N-CH_2), 3.66 (s,3H, -OCH_3); IR (KBr): 2865, 1765, 1675, 754 cm^{-1}; MS: *m/z* 424 (M+1). Anal. Calcd C, 65.24; H, 5.00; N, 3.31. Found: C, 65.00; H, 4.85; N, 3.20%.

Methyl-2-[2-hydroxybenzylidine]-4-[2-(phthalimide)-ethoxy]acetoacetate 5e

Mol. formula $C_{22}H_{19}NO_7$, light yellow oil, Yield: 9.38g (70%): ^{1}H NMR (DMSO-d_6): δ 7.85(s, 1H, -CH), 7.83-7.43(m, 4H, Ar-H), 7.30-7.22 (dd, 2H, *J* = 8 Hz, Ar-H), 6.92-6.86 (dd, 2H, *J* = 8.1 Hz, Ar-H), 5.72(s, 1H, -OH), 4.25 (s, 2H, *J* = 7.6 Hz, -O-CH_2-C=O), 3.66-3.63 (t, 2H, *J* = 7.8 Hz, -O-CH_2), 3.61-3.59 (t, 2H, -N-CH_2), 3.50 (s, 3H, -OCH_3); IR (KBr): 2860, 1760, 1679, 759 cm^{-1}; MS: *m/z* 410 (M+1). Anal. Calcd C, 64.54; H, 4.68; N, 3.42. Found: C, 64.15; H, 4.50; N, 3.20%.

Methyl-2-[3-nitrobenzylidine]-4-[2-(phthalimide)-ethoxy]acetoacetate 5f

Mol. formula $C_{22}H_{18}N_2O_8$, light yellow oil, Yield: 10.77g (75%): ^{1}H NMR (DMSO-d_6): δ 7.88(s, 1H, -CH), 7.76(m, 1H, Ar-H), 7.51-7.47(m, 4H, Ar-H), 7.44-7.43 (m, 3H, Ar-H), 4.25 (s, 2H, -O-CH_2-C=O), 3.79-3.76 (t, 2H, *J* = 8 Hz, -O-CH_2), 3.73-3.68 (t, 2H, *J* = 8 Hz, -N-CH_2), 3.62 (s ,3H, -OCH_3); IR (KBr): 2865, 1760, 1675, 759 cm^{-1}; MS: *m/z* 439 (M+1). Anal. Calcd C, 60.27; H, 4.14; N, 6.39. Found: C, 60.12; H, 4.00; N, 6.10%.

Methyl-2-[3,4,5-trimethoxybenzylidine]-4-[2-(phthalimide)ethoxy]acetoacetate 5g

Mol. formula $C_{25}H_{25}NO_9$, light yellow oil, Yield: 11.39g (72%): ^{1}H NMR (DMSO-d_6): δ 7.86(s,1H, -CH), 7.84-7.78(m, 4H, Ar-H), 7.62(s, 1H, Ar-H), 7.52(s, 1H, Ar-H), 4.28 (s, 2H, -O-CH_2-C=O), 3.84 (s, 6H, -OCH_3), 3.80 (s, 3H, -OCH_3), 3.78-3.75 (t, 2H, *J* = 7.8 Hz, -O-CH_2), 3.73-3.70 (t, 2H, *J* = 7.6 Hz, -N-CH_2), 3.67 (s, 3H, -OCH_3); IR (KBr): 2857, 1763, 1685, 760 cm^{-1}; MS: *m/z* 484 (M+1). Anal. Calcd C, 62.11; H, 5.21; N, 2.90. Found: C, 62.00; H, 5.02; N, 2.65%.

Methyl-2-[6-methoxynaphthylbenzylidine]-4-[2-(phthalimide)ethoxy]acetoacetate 5h

Mol. formula $C_{23}H_{21}NO_7$, light yellow oil, Yield: 13.02g (84%): ^{1}H NMR (DMSO-d_6): δ 8.46(s, 1H, Ar-H), 8.05-8.03(d, 1H, *J* = 8.85 Hz, Ar-H), 7.93-7.91(d, 1H, *J* = 8 Hz, Ar-H), 7.89(s,1H, -CH), 7.84-7.82(d, 1H, *J* = 8.8 Hz, Ar-H), 7.77-7.67(m, 4H, Ar-H), 7.43-7.42 (dd, 1H, *J* = 2.2 Hz, Ar-H), 7.28-7.26(dd, 1H, *J* = 2.4 Hz, Ar-H), 4.32 (s, 2H, -O-CH_2-C=O), 3.84 (s,3H, -OCH_3), 3.77-3.74 (t, 2H, *J* = 7.8 Hz, -O-CH_2), 3.66-3.63 (t, 2H, *J* = 7.8 Hz, -N-CH_2), 3.29 (s, 3H, -OCH_3); IR (KBr): 2870, 1765, 1680, 760 cm^{-1}; MS: *m/z* 474 (M+1). Anal. Calcd C, 68.49; H, 4.90; N, 2.96. Found: C, 68.25; H, 4.50; N, 2.65%.

Anti-inflammatory activity

The anti-inflammatory activity[18] was determined by Carrageenan induced acute paw oedema in rats. Wistar rats of either sex selected by random sampling technique were used for the study. Indomethacin 20 mg/kg was administered as standard drug for comparison. The test compounds were administered orally by intragastric tube. After half an hour of administration of test compounds, 0.1 mL of carrageenan was injected into the lateral malleolus of

the sub plantar region of the left hind paw. The inflammation of the paw was measured for all the animals using plathysmography before the administration of the carrageenan and after the administration of the carrageenan at 60, 120, 180, 240 and 300 min. The percentage protection of the compounds was calculated and presented in **Table I**.

In vitro Antimicrobial activity

The compounds **5a-h** were screened for their antibacterial activity against *Escherichia coli, Salmonella typhi, Staphylococcus aureus* and *Bacillus subtilis* by using paper disc diffusion method[19,20] using Penicillin (100 µg/disc) as reference standard, and antifungal activity against *Aspergillus niger, Aspergillus flavus, Penicillium chrysogenum* and *Fusurium moneliforme* by using Greseofulvin (100 µg/disc) as reference standard. Compounds **5b, 5c** and **5e** showed potent antimicrobial activity when compared to all the compounds. The observed Minimum Inhibitory Concentrations (MIC) values for all the synthesized compounds are presented in **Tables II** and **III**.

Conclusion

The synthesized chalcones of phthalimidoester **5a-h,** are novel and can be used as an intermediate for synthesizing various heterocyclic moieties. Compounds with electron releasing groups such as methoxy and hydroxyl showed good anti-inflammatory and antimicrobial activity than those which do not have such groups. Compounds having pharmacophores such as, chloro, fluoro and bromo groups have exhibited best anti-inflammatory and antimicrobial activity. These results suggest that the synthesized novel chalcones of phthalimidoester have excellent scope for further development as commercial anti-inflammatory and antimicrobial agents. Further experiments are needed to elucidate their mechanism of action.

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