SYNTHESIS, MOLECULAR DOCKING AND BIOLOGICAL EVALUATION OF SOME NOVEL N-CARBAMOYL PYRAZOLINES AS POTENT ANTI-INFLAMMATORY, ANTIOXIDANT AND ANTIDIABETIC AGENTS

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ABSTRACT
The present study was carried out to synthesize a series of some Novel N-carbamoyl pyrazoline derivatives, their docking studies and study their biological activities, in vitro anti-inflammatory, antioxidant and antidiabetic activities. Title compounds were synthesized by the reaction of pyrazole based chalcones and semicarbazide in the presence of NaOH. The pyrazole chalcones in turn were synthesized by condensation of pyrazole aldehyde with various substituted acetophenones. Synthesis of pyrazole aldehyde was carried out by vilsmeir Hack formylation of phenyl hydrazones. All synthesized N-carbamoyl pyrazolines were studied for their in vitro anti-inflammatory, antioxidant and antidiabetic activities. A docking study was carried out for anti-inflammatory and antidiabetic activity. Some of the synthesized compounds show excellent anti-inflammatory activity in comparison to standard Diclofenac sodium whereas some N-carbamoyl pyrazolines show potent anti-inflammatory activity. On the other hand, the antioxidant study was carried out by studying % inhibition for 2, 2-diphenyl-1-picrylhydrazyl (DPPH) radical, Nitic Oxide free radical (NO) and Superoxide radical (SOR) in comparison to standard ascorbic acid. Synthesized pyrazolines showed excellent to good antioxidant activity. The antidiabetic activity was carried out by assay of α-amylase inhibition using acarbose as standard. All synthesized N-carboamyl pyrazolines showed potent to moderate antidiabetic activity.

Keywords: Docking, Antidiabetic, Anti-inflammatory, Antioxidant, Pyrazoline, Chalcone.

INTRODUCTION
Pyrazolines are important five-member heterocyclic compounds and are found to have potential anti-inflammatory, antipyretic, antimicrobial, tranquillizing, anticancer, antihypertensive, antiarrhythmic, antitubercular, antidiabetic and Anti-Amoebic activity. Inflammation is a reaction of the body to infection or another injury, by showing symptoms like redness, warmth, swelling and pain. Research reveals that a large number of pyrazolines showed excellent anti-inflammatory activity. On the other hand, free radicals are a molecule that bears an unpaired electron; they are very reactive and are capable of generating new radicals. Reactive oxygen species are one of them which possess the ability to bind to cellular structures and show various pathological processes such as aging, inflammation, reoxygenation of ischemic tissues, atherosclerosis, cancer and even Parkinson’s disease in men. Antioxidants inhibit the process of oxidation, even at very low concentrations. A variety of substituted pyrazolines has been synthesized to date having antioxidant activity hence pyrazoline moiety is having increasing importance as antioxidant agent. Diabetes mellitus is a very common disease nowadays affecting the citizens of a large number of countries. About 25 % population of the world is suffering from this disease. It occurs due to abnormal carbohydrate metabolism which is responsible for low blood insulin level or insensitivity of target organs to insulin.

http://dx.doi.org/10.31788/RJC.2020.1335637
body’s systems, like eyes, kidneys, nerves, heart and blood vessels.\textsuperscript{19,20} Hence there is great need nowadays to synthesize new antidiabetic drugs with high potency. Pyrazoline moiety may be useful in designing new antidiabetic drugs. Given the above observations, it would be interesting to synthesize some new molecules having pyrazole moiety to study their biological activities. In this regard, methoxy chalcones would be suited for preparing pyrazoline. In our research work, we have synthesized a novel series of N-carboamyl pyrazoline derivatives from pyrazole based chalcones and studied their biological activities.

**EXPERIMENTAL**

**Material and Methods**

The title compounds were synthesized by reacting Pyrazole chalcones with phenylhydrazine in the presence of NaOH. Melting points (°C) were determined in the laboratory using the Thiels tube and are incorrect. IR spectra were recorded on FT-IR spectrometer Nicolet IS10 Thermo using the KBr disc method. \textsuperscript{1}H NMR spectra were recorded on Bruker 400 MHz spectrometer in CDCl\textsubscript{3} as a solvent. \textsuperscript{13}C NMR spectra were recorded on Brucker 400 MHz spectrometer in CDCl\textsubscript{3} as a solvent. All the reagents and solvents were used for an analytical grade. TLC was performed on silica gel coated plates for monitoring the reactions.

**Synthesis of Pyrazole based N-Carbamoylpyrazoline Derivatives (6a-j)**

5-(4-methoxyphenyl)-1',3'-diphenyl-3,4-dihydro-1'H,2H-[3,4-bipyrazole]-2-carboxamide: 6a

Yield 92%; M.P: 198-200°C; IR(KBr): 3458.61(C-NH\textsubscript{2} stretching), 3065.16(C-H Aromatic stretching ), 2848.10(C-H stretching of CH\textsubscript{2} group), 1651.33 (C=O stretching), 1539.90 (C=C stretching), 1258.45 (C-O-C stretching ); \textsuperscript{1}HNMR: 3.10 (dd, 1H, J=4Hz H-of pyrazoline CH\textsubscript{2}), 3.91(s, 3H-OCH\textsubscript{3}), 3.66(1H,dd, J= 12Hz, H of pyrazoline -CH), 5.83 (1H, dd, J=4Hz, H of pyrazoline CH\textsubscript{2}), 6.90-7.85 (14H, Ar-H); \textsuperscript{13}CNMR:δ 41.63 (Pyrazoline CH\textsubscript{2}), 52.54 (-OCH\textsubscript{3}), 55.39(CH-N), 114.09-133.29 (Ar-C), 150.09 (C=N of pyrazole), 152.33 (C=N Pyrazoline), 155.39 (C=OCH\textsubscript{3}), 161.21 (C=O)

3',5-bis(4-methoxyphenyl)-1'-phenyl-3,4-dihydro-1'H,2H-[3,4-bipyrazole]-2-carboxamide: 6b

Yield:90%; M.P: 210-212°C IR(KBr): cm\textsuperscript{-1} 3429.51 (C-NH\textsubscript{2}), 2917.15 (Ar-C-H), 1662.09(C=O), 1591.30 (C=C stretching), 1245.33 (C-O-C); \textsuperscript{1}HNMR:δ 3.08(dd, 1H, J=4Hz, H-of pyrazoline CH\textsubscript{2}), 3.855(s, 6H, -OCH\textsubscript{3}), 3.68(1H, dd, J= 12Hz, H of pyrazoline CH\textsubscript{2}), 6.90-7.85(14H, Ar-H); \textsuperscript{13}CNMR: δ42.64 (Pyrazoline CH\textsubscript{2}), 55.56 (-OCH\textsubscript{3}), 55.30 (-OCH\textsubscript{3}), 114.06-139.96 (Ar-C), 152.38 (C=N), 159.51(C=OCH\textsubscript{3}), 161.20 (C=O)

3'-15-dimethoxyphenyl)-1',5-diphenyl-3,4-dihydro-1'H,2H-[3,4-bipyrazole]-2-carboxamide 6c

Yield: 90%; M.P: 200-202°C. IR(KBr): cm\textsuperscript{-1} 3481.71, 3275.80 (C-NH\textsubscript{2}) 2917.15(Ar-C-H),1669.15 (C=O), 1538.24 (C=C), 1240.46(C-O-C); \textsuperscript{1}HNMR:δ 3.11(dd, 1H, J=6Hz H-of pyrazoline CH\textsubscript{2}), 3.84(s, 3H, -OCH\textsubscript{3}), 3.68(1H, dd, J= 12Hz, H of pyrazoline CH\textsubscript{2}), 5.41(bs-NH\textsubscript{2}), 5.83(bs-NH\textsubscript{2}), 5.82(1H, dd, J=4Hz, H of pyrazoline CH\textsubscript{2}), 6.90-7.86(14H, Ar-H); \textsuperscript{13}CNMR: 842.64 (Pyrazoline CH\textsubscript{2}), 55.56 (-OCH\textsubscript{3}), 55.30 (-OCH\textsubscript{3}), 114.06-139.96 (Ar-C), 152.38 (C=N), 159.51(C=OCH\textsubscript{3}), 161.20 (C=O)

5-(2,4-dimethoxyphenyl)-1',3'-diphenyl-3,4-dihydro-1'H,2H-[3,4-bipyrazole]-2-carboxamide: 6d

Yield 92%; M.P: 208-210°C. IR(KBr): cm\textsuperscript{-1} 3477.18(C-NH\textsubscript{2}), 2931.10(C-O-C); \textsuperscript{1}HNMR:δ 3.10(dd, 1H, J=4Hz, H-of pyrazoline CH\textsubscript{2}), 3.84(s, 3H, -OCH\textsubscript{3}), 3.66(1H, dd, J= 12Hz, H of pyrazoline CH\textsubscript{2}), 5.33(bs-NH\textsubscript{2}), 5.82(1H, dd, J=4Hz, H of pyrazoline CH\textsubscript{2}), 6.96-7.86(14H, m); \textsuperscript{13}CNMR: 42.49 (-CH\textsubscript{2} of pyrazoline), 52.69 (C-N), 55.30 (-OCH\textsubscript{3}), 114.07-139.94 (Ar-C), 150.02 (C=N of pyrazole), 152.54(C=N of pyrazole), 152.54(C=OCH\textsubscript{3}), 159.54 (C=O)
5-(2,5-dimethoxyphenyl)-1',3'-diphenyl-3,4-dihydro-1'H,2H-[3,4-bipyrazole]-2-carboxamide: 6e
Yield 88%; M.P: 206-208°C; IR(KBr):3395.64 (N-H stretching), 2917.27 (Ar-C-H stretching), 2848.71 (C-H stretching of CH$_2$ group), 1651.33 (C=O stretching), 1229.83 (C-O-C stretching) $^8$HNMROselect 3.09 (dd, 1H, J=4Hz, H-of pyrazoline CH$_2$), 3.83(s, 6H, -OCH$_3$), 3.67(1H, dd, J=12Hz, H-of pyrazoline CH$_2$), 5.45(bs-NH$_2$), 5.82(1H, dd, J=8Hz, H-of pyrazoline CH$_3$), 6.96-7.86(14H, Ar-H) $^{13}$CNMR: δ 42.58 (Pyrazoline CH$_2$), 52.69(CH-N), 55.29 (-OCH$_3$), 55.38 (-OCH$_3$), 114.41-139.90 (Ar-C), 149.98 (C=N of pyrazole), 154.23 (C=N of pyrazoline), 155.24 (C=O), 156.78 (C=O)

5-(3-methoxyphenyl)-3'-(4-methoxyphenyl)-1'-phenyl-3,4-dihydro-1'H,2H-[3,4-bipyrazole]-2-carboxamide: 6f
Yield: 84%; M.P: 200-202°C; IR(KBr): cm$^{-1}$ 3290.51 (C-NH$_2$), 2918.56 (C-H aromatic stretching), 2848.80 (C-H stretching of CH$_2$ group), 1651.96 (C=O), 1529.68 (C-O-C), $^8$HNMROselect 3.10 (dd, 1H, J=4Hz, H-of pyrazoline CH$_2$), 3.85(s, 6H, -OCH$_3$), 3.67(1H, dd, J=12Hz, H-of pyrazoline CH$_2$), 5.37(bs-NH$_2$), 5.83(1H, dd, J=4Hz, H-of pyrazoline CH$_2$), 6.96-7.86 (14H, Ar-H), $^{13}$CNMR: 41.62 (CH$_2$ of pyrazoline), 55.41 (-OCH$_3$), 57.47 (-OCH$_3$), 123.25-132.51 (Aromatic C), 154.16 (C=N), 161.55 (C=O), 158.88 (C=O)

3'-(4-methoxyphenyl)-1'-phenyl-5-(3,4,5-trimethoxyphenyl)-3,4-dihydro-1'H,2H-[3,4'-bipyrazole]-2-carboxamide: 6g
Yield: 90%; M.P: 214-216°C; IR(KBr): cm$^{-1}$ 3285.52 (Ar-C-H), 2917.63 (C-H aromatic stretching), 2848.62 (C-H stretching of CH$_2$ group), 1651.05 (C=O), 1529.84 (C-O-C), $^8$HNMROselect 3.09 (dd, 1H, J=4Hz, H-of pyrazoline CH$_2$), 3.83-3.92(s, 12H, -OCH$_3$), 3.66(1H, dd, J=12Hz, H-of pyrazoline CH$_2$), 5.37(bs-NH$_2$), 5.83(1H, dd, J=4Hz, H-of pyrazoline CH$_2$), 6.96-7.86 (13H, Ar-H), $^{13}$CNMR: 41.78 (pyrazoline –CH$_2$), 55.60 (-OCH$_3$), 56.29 (-OCH$_3$), 61.01(-OCH$_3$), 123.32-145.292 (Ar-C), 154.32 (C=N of pyrazole), 154.14 (C=N of pyrazoline), 158.36 (C=O)

5-(3,4-dimethoxyphenyl)-1',3'-diphenyl-3,4-dihydro-1'H,2H-[3,4-bipyrazole]-2-carboxamide: 6h
Yield 92%; M.P: 208-210°C; IR(KBr): cm$^{-1}$ 3458.61 (C-NH$_2$ stretching), 2917.50 (Aromatic C-H stretching), 1651.33 (C=O stretching), 1539.90 (C=C stretching), 1258.45 (C-O-C stretching), $^8$HNMROselect 3.08(dd, 1H, J=4Hz, H-of pyrazoline CH$_2$), 3.84-3.86 (s, 6H, -OCH$_3$), 3.67(1H, dd, J=12Hz, H-of pyrazoline CH$_2$), 5.81(1H, dd, J=4Hz, H-of pyrazoline CH$_2$), 6.90-7.85 (14H, Ar-H), $^{13}$CNMR: 42.24(-CH$_2$ of pyrazoline), 52.77 (C=N), 55.29 (-OCH$_3$), 55.38 (-OCH$_3$), 114.05-140.04 (Ar-C), 150.51 (C=N of pyrazole), 158.88 (C=O)

3'-4-(4-methoxyphenyl)-1'-phenyl-5-(3,4,5-trimethoxyphenyl)-3,4-dihydro-1'H,2H-[3,4'-bipyrazole]-2-carboxamide: 6i
Yield 92%; M.P: 218-220°C; IR(KBr): cm$^{-1}$ 3547.44 (C-NH$_2$), 2917.55 (Ar-C-H stretching), 1638.22 (C=O), 1510.23 (C=C), 1291.83 (C-O-C), $^8$HNMROselect 3.11 (dd, 1H, J=4Hz, H-of pyrazoline CH$_2$), 3.83-3.92 (s, 12H), 3.66(1H, dd, J=12Hz, H-of pyrazoline CH$_2$), 5.39(1H, dd, J=4Hz, H-of pyrazoline CH$_2$), 6.83-7.84(11H, m), $^{13}$CNMR: 42.62(-CH$_2$ of pyrazoline), 52.69 (C-N), 55.30-60.99 (-OCH$_3$), 114.05-140.04 (Ar-C), 153.32 (C=N), 155.10 (C=O), 159.52 (C=O)

1',3',5-triphenyl-3,4-dihydro-1'H,2H[3,4'-bipyrazole]-2-carboxamide: 6j
Yield 92%; M.P: 198-200°C; IR(KBr): cm$^{-1}$ 3547.44 (C-NH$_2$), 2917.55 (Aromatic C-H stretching), 1638.22 (C=O), 1510.23 (C=C), 1291.83 (C-O-C), $^8$HNMROselect 3.04(dd, 1H, J=4Hz, H-of pyrazoline CH$_2$), 3.85(s, 6H, -OCH$_3$), 3.61(1H, dd, J=12Hz, H-of pyrazoline CH$_2$), 5.56(bs-NH$_2$), 5.77(1H, dd, J=4Hz, H-of pyrazoline CH$_2$), 6.90-7.85 (15H, Ar-H), $^{13}$CNMR: 42.98(-CH$_2$ of pyrazoline), 52.67 (C-N), 114.08-039.94 (AR-C), 152.54 (C=N of pyrazole), 152.51(C=N of pyrazoline), 159.62 (C=O)

Pharmacology

*In-vitro* Anti-inflammatory Activity by Protein Denaturation Method

A mixture of 0.1 mL of egg albumin (from fresh hen’s egg), 1.4 mL of phosphate buffered saline (PBS, pH 6.4) and 1 mL of synthesized N-carbamoyl pyrazoline at 1mM concentration was incubated at (37°C
±2) in an incubator for 15 min. Then reaction mixture was heated at 70°C for 5 min. Similar volume of double-distilled water was used as control. Reaction mixture was cooled; absorbance of reaction mixture and control were measured at 660 nm, vehicle was used as blank. Diclofenac sodium at 1mM concentration was used as reference drug and treated similarly for determination of absorbance. The % inhibition of protein denaturation was calculated by using the following formula given below:

\[
\%\ inhibition = 100 \times \left( \frac{V_t}{V_c} - 1 \right)
\]

Where, \(V_t\) = absorbance of test sample, \(V_c\) = absorbance of control

**Antioxidant Activity**

**DPPH Radical Scavenging Activity**

1 ml of N-carbamoyl pyrazoline at 1 mM concentration was mixed with 3.0 mL DPPH (0.5 mmol/L in methanol), the reaction mixture was incubated at 37°C for 30 minutes; the absorbance of the reaction mixture was recorded at 517 nm. The percentage of scavenging activity was calculated using the formula,

\[
\text{Percentage of Inhibition (\%)} = \left( \frac{A_{control} - A_{sample}}{A_{control}} \right) \times 100
\]

Where, \(A_{control}\) - absorbance of DPPH and \(A_{sample}\) - absorbance reaction mixture (DPPH with Sample)

**NO Scavenging Activity**

1mL of 10 mM sodium nitroprusside dissolved in 0.5 mL phosphate buffer saline (pH 7.4) was mixed with 1 mL of 1 mM N-carbamoyl pyrazoline dissolved in DMSO. The reaction mixture was incubated at 25°C for 150 min. After incubation, the reaction mixture was mixed with 1.0 mL of pre-prepared Griess reagent [(1.0 mL sulfanilic acid reagent (0.33% in 20% glacial acetic acid at room temperature for 5 minutes with 1 mL of naphthyl ethylenediamine dichloride (0.1% w/v)]. The mixture was then incubated at room temperature for 30 min and its absorbance was measured by pouring into a cuvette at 546 nm. The decreasing absorbance indicated a high nitric oxide scavenging activity. The amount of NO radical inhibition was calculated as below:

\[
\%\ inhibition\ of\ NO\ radical = \left[ \frac{A_0 - A_1}{A_0} \right] \times 100
\]

Where \(A_0\) is the absorbance before reaction and \(A_1\) is the absorbance after reaction with Griess reagent.

**SOR Scavenging Activity**

1.0 mL of N-carbamoyl pyrazoline (1mM) solution was added to 3.0 mL of Tris–HCl buffer (16 mM, pH 8.0), containing 0.5 mL of nitroblue tetrazolium (NBT) (0.3 mM), 0.5 mL NADH (0.936 mM) solution. The reaction was initiated by adding 0.5 mL phenazine methosulfate (PMS) solution (0.12 mM) to the reaction mixture, the reaction mixture was incubated at 25°C for 5 min and then the absorbance was measured at 560 nm against a blank sample. Decreased absorbance of the reaction mixture indicated increased superoxide anion scavenging activity.

**Antidiabetic Activity**

**Assay of Amylase Inhibition**

100 μL of samples (1mM) was reacted with 200 μL of the α-amylase enzyme (Diastase) and 100 μL of 2 mM of phosphate buffer (pH-6.9). The reaction mixture was incubated for 20 minutes. After a 20-minute incubation, 100 μL of 1% starch solution was added. The same was performed for the controls where 200 μL of the enzyme was replaced by the buffer. After incubation, 500 μL of dinitrosalicylic acid reagent was added to both control and test. They were kept in boiling water bath for 5 min. The absorbance was recorded at 540 nm using spectrophotometer and the percentage inhibition of α-amylase enzyme was calculated using the formula:

\[
\%\ Inhibition = \left[ \frac{A_{control} - A_{test}}{A_{control}} \right] \times 100
\]

Where \(A_{control}\) = absorbance of control and \(A_{test}\) = Absorbance of test

**Molecular Docking**

Molecular docking was performed to predict the molecular mechanism of the developed molecules. Crystal structure of Human COX II (5KIR), while the Crystal structure of the human peroxisome...
RESULTS AND DISCUSSION

The pyrazolines were synthesized as outlined in Scheme-1. Pyrazole aldehyde is obtained via vilsmeir Haack reaction by treating acetophenone and phenylhydrazine to give the corresponding hydrazone which on reaction with DMF/POCl3 gives pyrazole aldehyde (3). The pyrazolechalcones (5a-1j) were prepared by reaction of various methoxy substituted acetophenones and pyrazole aldehyde (3) in the presence of NaOH. These chalcones were treated with semicarbazide in the presence of NaOH and heated for 4-5 hrs to afford pyrazoline derivatives (6a-j). The completion of the reaction was monitored by TLC. All the synthesized pyrazolines were characterized by IR, 1HNMR and 13CNMR. The IR spectra of N-carbamoyl pyrazolines shows that the (C=O) absorption bands were at 1609-1638 cm⁻¹ and the (C=N) stretching bands were observed at 1595 cm⁻¹. These values confirm the formation of desired pyrazoline derivatives. In the 1HNMR spectra of pyrazolines, the chiral methine proton appeared at ~ δ 3.2-3.3 and ~5.91-5.95 as two distinct doublets of a doublet which is a characteristic chemical shift and splitting pattern of pyrazolines.

All the synthesized N-carbamoylpyrazolines were evaluated for their anti-inflammatory, antioxidant and antidiabetic activities. Results of which have been shown in Table-1.

**Anti-inflammatory Activity**

All synthesized compounds were also tested for their anti-inflammatory activity²¹ using diclofenac sodium as standard drug. It can be observed from the results that all N-carbamoyl pyrazolines show good anti-inflammatory activity. Compound 6h shows maximum anti-inflammatory activity in comparison to the standard. Compounds 6e, 6d, 6g and 6l have shown potent anti-inflammatory activity. Compounds 6a, 6b, 6c and 6j possess moderate activity whereas 6c showed the least anti-inflammatory activity in the series.

**Antioxidant Activity**

Antioxidant activity of synthesized N-carbamoyl pyrazoline derivatives was studied against reactive oxygen species like DPPH, Nitric oxide and Superoxide radical scavenging activity²² using ascorbic acid as a standard antioxidant agent and presented in Table-1.
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Antioxidant activity study reveals that compounds 6a, 6d, 6g and 6j show excellent antioxidant activity for DPPH radical. Compound 6f showed maximum inhibition for NO and SOR free radical.

Table-1: Biological Activities of N-Carboamyl Pyrazolines

| Compounds | Anti-inflammatory Activity | DPPH | Nitric Oxide Scavenging Activity | Superoxide Scavenging Activity | Antioxidant Activity %Inhibition |
|-----------|---------------------------|------|----------------------------------|-------------------------------|--------------------------------|
| 6a        | 59.79                     | 84.07| 35.93                            | 04.87                         | 21.73                         |
| 6b        | 67.01                     | 07.07| 31.25                            | 82.92                         | 54.34                         |
| 6c        | 49.48                     | 08.84| 35.93                            | 17.07                         | 50.00                         |
| 6d        | 78.35                     | 83.78| 06.25                            | 25.60                         | 50.00                         |
| 6e        | 61.85                     | 08.84| 06.25                            | 39.02                         | 43.47                         |
| 6f        | 59.39                     | 06.19| 65.62                            | 76.82                         | 32.60                         |
| 6g        | 76.28                     | 83.06| 53.12                            | 78.04                         | 26.08                         |
| 6h        | 81.44                     | 03.53| 37.50                            | 57.31                         | 36.95                         |
| 6i        | 70.10                     | 27.43| 20.31                            | 54.87                         | 43.47                         |
| 6j        | 64.94                     | 82.43| 06.25                            | 32.92                         | 58.69                         |
| Diaclofenac Sodium | 85.56           |      |                                  |                               | 76.08                         |
| Ascorbic Acid | 92.03                  | 71.87|                                  | 90.24                         |                               |
| Acarbose |                           |      |                                  |                               |                               |

% Inhibition was calculated by measuring absorbance at 660 nm for anti-inflammatory activity, 517 nm for DPPH, 546 nm for NO, 560 nm for SOR and 540 nm for antidiabetic activity.

**Antidiabetic Activity**

Antidiabetic activity of synthesized N-carbamoyl pyrazolines was tested by the method using assay of amylase inhibition and % inhibitions of the compounds were determined as compared to standard acarbose. All the compounds showed excellent inhibition of amylase in comparison to standard acarbose and the results have been shown in Table-1. Compounds 6j and 6h are having more potent antidiabetic activity from the series whereas compounds 6c, 6d, 6e and 6i are showing good antidiabetic activity as compared to standard acarbose.

From the above discussion, it can be noted that all the synthesized N-carboamyl pyrazoline derivatives are having potential biological activities and they can be useful in designing new drugs.

**Molecular Docking**

Molecular Docking was utilized to study the mode of action of the synthesized derivatives for anti-inflammatory and anti-diabetic activity. Crystal structure of Human COX II (5KIR), while Crystal structure of the human peroxisome proliferator-activated receptor gamma (2PRG) downloaded from the free protein database [www.rcsb.org](http://www.rcsb.org) was utilized for docking analysis. Grip based docking analysis was carried out using biopredicta molecule of Vlife MDS 4.6.

**Docking Study For Anti-inflammatory Activity**

All synthesized derivatives have shown the same binding mode for anti-inflammatory activity. 6h is the most active molecule showed important binding interactions like hydrogen bond interactions with VAL523, TYR385, aromatic interactions with HIS90, TYR348, TYR385 and hydrophobic interactions with THR206, VAL344, VAL349, LEU352, GLY526, SER530, LEU534. 6e showed hydrogen bond interaction with HIS90 aromatic interaction with TRP387, PHE518 hydrophobic interactions with VAL116, VAL349, LEU352, VAL523, ALA527, SER530. 6d showed hydrogen bond interaction with MET522, aromatic bond interaction with HIS90, TYR348, TYR385, PHE518 and hydrophobic interactions with VAL344, VAL349, LEU352, LEU384, VAL523, GLY526, SER530, LEU534. 6g showed hydrogen bond interactions HIS90, TYR355, aromatic bond interaction with HIS90,
PHE518 and hydrophobic interactions with HIS90, THR94, VAL116, ARG120, VAL349, LEU352, SER353, ILE517, PHE518, VAL523, ALA527, SER530, LEU531. 6i showed hydrogen bond interaction with SER530, aromatic bond interactions with HIS90, TYR355 and hydrophobic interactions with LEU93, ARG120, LEU352, SER353, PHE518, VAL523, GLY526, ALA527, PRO528, PHE529, SER530, LEU531.
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Fig. 1: Molecular Docking For Anti-inflammatory Activity
Some Novel N-Carbamoyl Pyrazolines

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Fig.-2: Molecular Docking For Antidiabetic Activity
Docking Study For Anti-diabetic Activity

All synthesized derivatives have shown same binding mode for anti-diabetic activity. 6b is the most active molecule showed important binding interactions like hydrogen bond interaction with ARG288, aromatic interaction with PHE287 and hydrophobic interactions with CYS285, PHE287, ARG288, GLU291, ALA292, ILE296, ILE326, MET329, ILE341. 6c showed hydrogen bond interactions with SER342, GLU291, aromatic interaction with PHE287 and hydrophobic interactions with VLEU270, ARG280, ILE281, GLY284, PHE287, ARG288. 6d showed hydrogen bond interaction with CYS285, aromatic bond interaction with PHE282, PHE360, PHE363, and hydrophobic interactions with CYS285, ARG288, ILE326, LEU330, LEU333, ILE341, SER342, GLU343. 6e showed hydrogen bond interaction with ARG288, aromatic bond interaction with PHE363 and hydrophobic interactions with CYS285, ARG288, ILE326, LEU330, LEU333, ILE341, SER342, GLU343. 6i showed hydrogen bond interactions with GLY284, TYR327 and aromatic bond interaction with PHE363 and hydrophobic interactions with CYS285, ARG288, ILE326, LEU330, LEU333, ILE341, LEU353, LEU356, MET364, HIS 449.

CONCLUSION

In summary, we have carried out the synthesis of novel series of N-carboamyl pyrazolines, carried out their docking studies and screened for in vitro anti-inflammatory, antioxidant and antidiabetic activities. The pyrazolines are having potent biological activities. Compound 6h showed excellent anti-inflammatory activity whereas compounds 6a, 6d, 6g and 6j showed excellent antioxidant activity for DPPH, compound 6f showed highest inhibition of NO free radical and compound 6b showed the highest inhibition for SOR free radical. On the other hand, compounds 6j and 6b were found to be having the most potent antidiabetic activity among the series as compared to standard acarbose. The synthesized compounds showed good docking scores for anti-inflammatory as well as antidiabetic activity. Hence these newly synthesized N-carboamyl pyrazoline derivatives may be of great interest in the field of medicinal chemistry.

ACKNOWLEDGMENT

We are very thankful to the School of Chemical Sciences, PAH, Solapur University, Solapur for providing laboratory facility and thankful to Biocyte laboratory, Sangali for carrying out biological evaluations. We are also thankful to the instrumentation center of PAH Solapur university and Savitribai Phule, Pune University.

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