International Research Journal of Pharmacy and Medical Sciences
ISSN (Online): 2581-3277

Antioxidant, Anti-inflammatory and Antidiabetic Activity of Some Novel Chalcone and Piperidine Derivatives

Monisha E[1], Suganya V[1], Anuradha V[2*], Syed Ali M[3]
[1, 2*]PG and Research Department of Biochemistry, Mohamed Sathak College of Arts & Science, Sholinganallur, Chennai, Tamil Nadu, India
[3]PG and Research Department of Biotechnology, Mohamed Sathak College of Arts & Science, Sholinganallur, Chennai, Tamil Nadu, India
[2*] Corresponding author Email. Id: vanuradha2712@gmail.com; Phone no: +91 9841751450.

Abstract*—In the pharmaceutical field, there is a need of new and novel chemical inhibitors with biological functions. Much of our efforts are focused on the introduction of chemical diversity in the molecular frame work in order to synthesizing pharmacologically interesting heterocyclic compounds with widely different composition. The research on determining the biological activity of heterocyclic synthetic compounds looks into the medicinal applications of these heterocyclic compounds. Several entities have been designed, generated and characterized using spectral studies. The objectives of the present work are to evaluate the in vitro antioxidant and free radical scavenging potential, Anti-inflammatory activity and Antidiabetic activity of the test compounds. Thus, the compounds Chalcone and Piperdine derivatives was found to exhibit good in vitro activity when compared with standard drugs*.

***Keywords*—** *Chalcone, Piperdine, DPPH, ABTS, Protein denaturation, HRBC, α Amylase, α Glucosidase*.

I. INTRODUCTION

Diseases and infections are recognized as a major medical challenge in most healthcare systems [1]. Resistance and multidrug-resistant pathogens are spreading with extraordinary speed globally [1] leading to increased mortality rates amongst patients infected [2]. Microorganisms are known to frequently form a resistance against pharmaceutically available drugs [3]. These drugs frequently lack selectivity and easy availability as well as unfavorable side effects [3]. The key to efficient and effective treatment of emerging diseases lies in the early stages of identification, diagnosis and treatment of these infections. Thus, there is a constant need for novel therapeutic agents. There has been a vast interest in the synthesis of heterocyclic compounds especially alkaloids due to their diverse reactivity, physiological and pharmacological activity [3-5]. Among these compounds, chalcone and piperidine play a major role against various diseases.

Piperidines are organic compounds consisting of a six membered ring with a molecular formula (CH2) 5NH.This heterocyclic amine consists of a six-membered ring containing five methylene bridges (-CH2-) and one amine bridge (-NH-) [6]. Heterocyclic compounds are referred to as compounds that have one or more atoms in the ring other than carbon. Amines containing nitrogen as part of a complex ring system commonly occur in nature. Piperidine is a simple nitrogen heterocyclic compound referred to as a secondary amine [7]. Piperidine is identified as a colorless fuming liquid with an odor described as ammoniacal, which is like pepper [8]. Therefore piperidine obtained its name from the genus name *Piper*, which is the Latin word for pepper [8].

The modified side chains are responsible for the antibiotic, antifungal, anti-oxidant, anti-inflammatory and anticancer properties [9]. Piperidine and its derivatives have a major impact in the medical field due to their wide range of pharmacological activities. The piperidine moiety is an essential pharmacophore which is found in numerous alkaloids, pharmaceuticals, agrochemicals and as synthetic and biological intermediates [10].

Piperidine and its derivatives are ubiquitous building blocks in the synthesis of pharmaceuticals and fine chemicals. The piperidine structure occurs in many pharmaceuticals such as paroxetine, risperidone, methylphenidate, raloxifene, minoxidil, thioridazine, haloperidol, droperidol, mesoridazine, meperidine, melperone the psychochemical agents Ditran-B (JB-329), *N*-methyl-3-piperidyl benzilate (JB-336) and in many others [11]. Piperidine derivatives are utilized for several pharmacological activities, much of these includes; antibacterial (Gram positive and Gram negative) [12,13], antifungal [12-14], anti-inflammatory, antioxidant, anti-HIV [12] and anticancer activities also known to exhibit insecticidal activity against mosquitoes and flies [15]. Piperidines are used commercially as solvents in curing agent and epoxy resins. They form intermediates; in organic synthesis, in foods as food additives, and as constituents in the manufacturing of pharmaceuticals [16].

The term "chalcone" is a generic term used to describe compounds with the 1,3-diphenylprop-2-en-1-one framework. Chalcones are intermediates in the biosynthesis of flavonoids, which are substances widespread in plants and with an array of biological activities. The presence of enone functionality in chalcone moiety confers biological activity upon it, like anti-inflammatory, antimitotic, anti-leishmanial, anti-invasive, anti-tuberculosis, anti-fungal, anti-malarial, anti-tumor, and anti-oxidant properties; as well as their recognized synthetic utility in the preparation of pharmacologically-interesting

Monisha E, Suganya V, Anuradha V, and Syed Ali M, "Antioxidant, Anti-inflammatory and Antidiabetic Activity of Some Novel Chalcone and Piperidine Derivatives," *International Research Journal of Pharmacy and Medical Sciences (IRJPMS)*, Volume 2, Issue 1, pp. 6-12, 2018.

heterocyclic systems like pyrazolines, which have also been largely studied owing to their pharmacological activities, which includes anti-tumor anti-inflammatory, anti-parasitary, anti-depressive, anticonvulsant, antimicrobial, antinociceptives and nitric oxide synthase inhibitors, associated with diseases such as Alzheimer, Huntington, and inflammatory arthritis [17].

II. Materials and Methods

Test Compounds of the Study

The synthetic compounds used for the present study was gifted by Dr.Asrar from Department of Chemistry, Jamal Mohamed College, Trichy, Tamilnadu. The compounds were synthetic derivatives of piperidine and chalcones. The chemical name of the compounds with their corresponding code is listed in the table below

S.No	Code	Chemical Name
1	MSN-12	3-benzyl-2,6-bis(1H-indol-3-yl)piperidin-4-one
2	MSN-13	3-benzyl-2,6-bis(3-nitrophenyl)piperidin-4-one
3	MSN-14	3-benzyl-2,6-bis(4-nitrophenyl)piperidin-4-0ne
4	MSN-15	3-benyzl-2,6-bis(2-hydroxyphenyl)piperidin-4-one
5	MSN-16	3-benzyl-2,6-bis(3-cholorophenyl)piperidin-4-one
6	MS-6	7-ethyl-2,4-bis(4-hydroxy-phenyl)-3-azabicyclo[3.3.1]nonan-9-one
7	MS-7	7-ethyl-2,4-bis(4-chloro-phenyl)-3-azabicyclo[3.3.1]nonan-9-one
8	MR-3	3,3-dichloro-2,6-bis(3-chlorophenyl)piperidin-4-one

In vitro Antioxidant, anti-inflammatory and antidiabetic Assays

Test compound piperidine and chalcones derivatives were assessed for in vitro antioxidant activity through DPPH, ABTS, Nitric oxide, Hydrogen peroxide, Superoxide dismutase and Lipid peroxidation methods [18]. Their invitro anti-inflammatory activity was carried out by protein denaturation and HRBC membrane stabilization method while antidiabetic activity was assessed α amylase and α glucosidase inhibition method [19, 20].

III. Results

1. Chemical Structures of the Test Compounds

Figure 1 to Figure 8 represents the chemical structure of eight test synthetic compound along with chemical formula

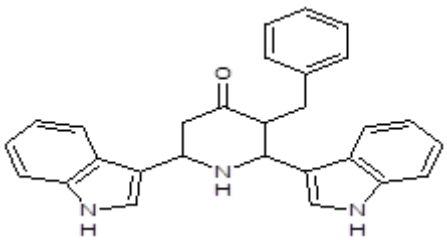


Fig. 1. MSN – 12-[$C_{28}H_{25}N_3O$]

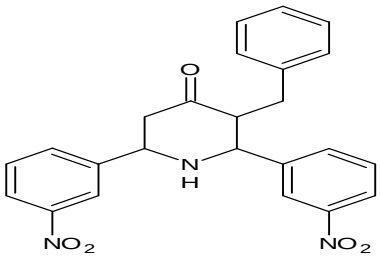


Fig. 2 MSN – 13-[.[$C_{24}H_{21}N_3O_5$]

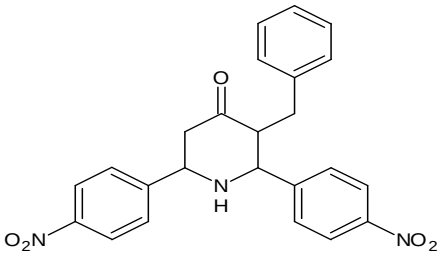


Fig. 3. MSN – 14-[$C_{24}H_{21}N_3O_5$]

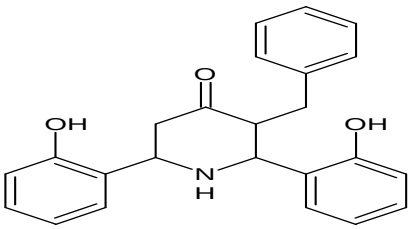


Fig. 4. MSN – 15-[$C_{24}H_{23}NO_3$]

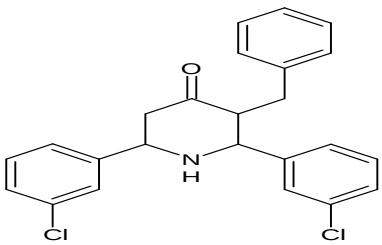


Fig. 5. MSN – 16-[$C_{24}H_{21}Cl_2NO$]

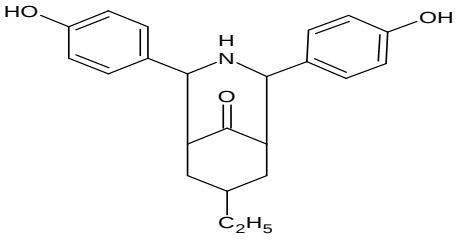


Fig. 6. MS-6-[$C_{22}H_{25}NO_3$]

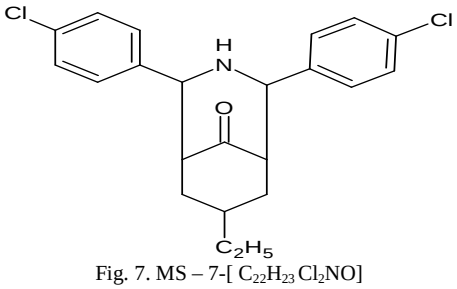


Fig. 7. MS – 7-[$C_{22}H_{23}Cl_2NO$]

Monisha E, Suganya V, Anuradha V, and Syed Ali M, "Antioxidant, Anti-inflammatory and Antidiabetic Activity of Some Novel Chalcone and Piperidine Derivatives," *International Research Journal of Pharmacy and Medical Sciences (IRJPMS)*, Volume 2, Issue 1, pp. 6-12, 2018.

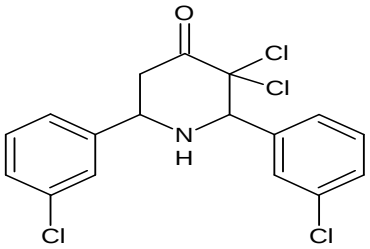
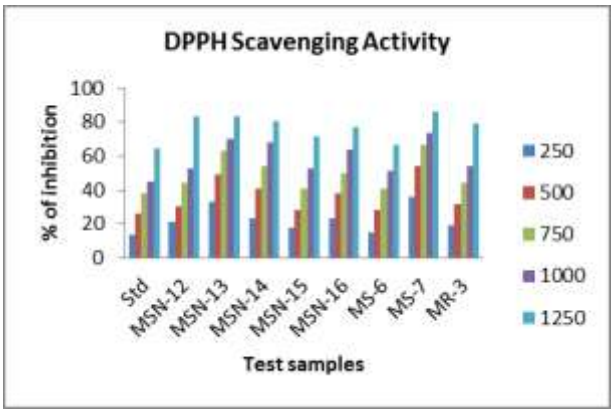


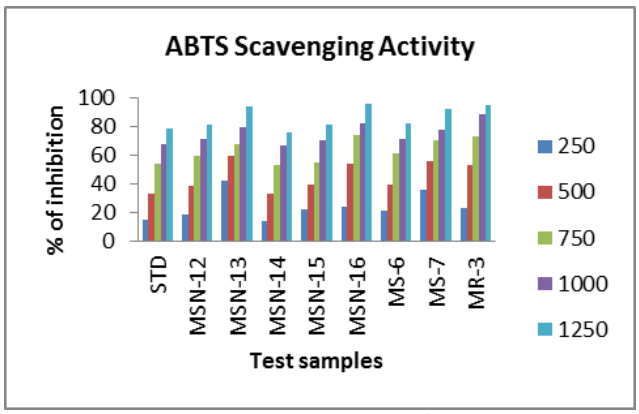
Fig. 8. MR – 3-[$C_{17}H_{13}Cl_4NO$]

2. In vitro Antioxidant and Free radical Scavenging Assays



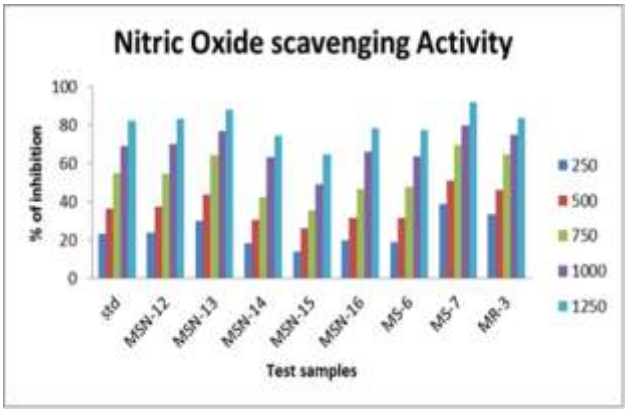
Graph 1. DPPH radical scavenging assay of test samples

The *in vitro* antioxidant activity of different compounds were estimated using DPPH, ABTS, Nitric oxide, SOD, Hydrogen peroxide and LPO using egg yolk. Graph 1 represents the DPPH scavenging activity of different compound when compared to the standard drug (64.71 %) the test samples shows higher activity in MS-7 (86.37 %) followed by MSN-13 (83.57 %), MSN-14 (80.87 %) and MR-3 (79.42 %). Moderate activity was founded in MSN-16 (76.71 %), MSN-12 (72.20 %) and MSN-15 (71.12 %) and lower activity was gained by MS-6 (66.61 %) but higher than the standard drug. The IC 50 values of standard was founded to be 1009.54 µg/ml and test samples in the range of 942.56 to 473.13 µg/ml which was calculated based on the percentage of inhibition the concentration in the range of 250 µg/ml to 1250 µg/ml.



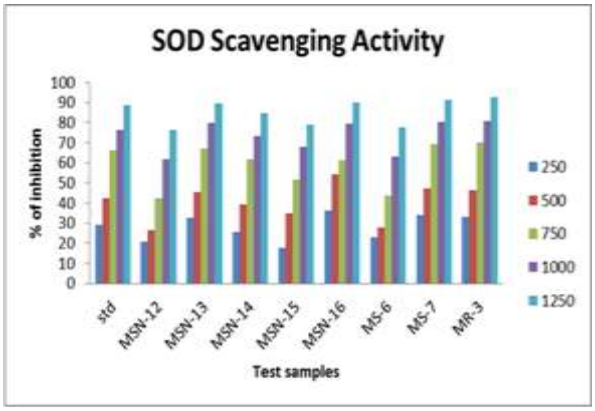
Graph 2. ABTS scavenging activity of test samples

The ABTS scavenging activity was done for different compound along with standard ascorbic acid (Graph 2). The control OD value was recorded as 1.934 which is used to calculate the percentage of samples. For the standard, highest inhibition was shown at the concentration 1250 µg/ml with inhibition of 78.75 % and the lowest inhibition was found at the concentration 250 µg/ml (14.53 %). At all concentration test samples such as MSN-12 (80.82 %), MSN-13 (93.995 %), MSN-15 (80.87 %), MSN-16 (95.14 %), MS-6 (81.80 %), MS-7 (91.83 %) and MR-3 (94.41 %) possesses higher percentage of inhibition when compared with standard drug and MSN-14 (76.01 %) possess lower activity.



Graph 3. Nitric oxide scavenging assay of test samples

In present study, the Nitric oxide activity of standard drug and different synthetic compound were determined and the results are presented in Graph 3. All these samples possessed the ability to scavenging Nitric oxide at various concentrations (250-1250µg/ml). The test sample MS-7 showed the maximum scavenging activity (38.64 % to 92.22%) with the IC 50 values 452.450 µg/ml than other test samples and the scavenging effect of standard was founded to be from 23.00 to 82.45 % with IC 50 values 697.750µg/ml.

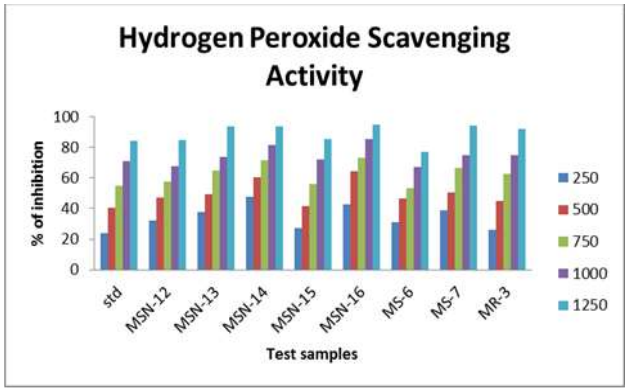


Graph 4. Superoxide Dismutase scavenging activity of test samples

Graph 4 demonstrates the SOD scavenging activity of test samples and standard with different concentration (250- 1250 µg/ml). From the result, it is determined that lowest percentage of inhibition was gained at 250 µg/ml for standard (29.14%) and highest values at 1250 µg/ml (88.70 %). When compared with standard, the test samples such as MSN-13 (89.89 %), MSN-16 (90.19 %), MS-7 (91.57 %) and MR-3

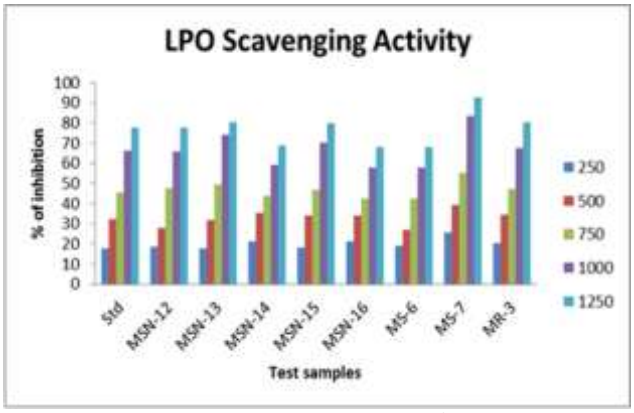
Monisha E, Suganya V, Anuradha V, and Syed Ali M, "Antioxidant, Anti-inflammatory and Antidiabetic Activity of Some Novel Chalcone and Piperidine Derivatives," *International Research Journal of Pharmacy and Medical Sciences (IRJPMS)*, Volume 2, Issue 1, pp. 6-12, 2018.

(92.76 %) showed high percentage of inhibition at 1250 µg/ml with IC 50 values 530.16, 479.14, 508.22 and 510.68 µg/ml whereas MSN-12 (76.41 %), MSN-14 (84.74 %), MSN-15 (79.19 %), MS-6 (77.60 %) showed low percentage of inhibition at 1250 µg/ml with IC 50 values 825.40, 633.56, 744.11 and 799.14 µg/ml. Standard drug possess 576.98 µg/ml of IC 50 value.



Graph 5. Hydrogen per oxide scavenging assay of test samples

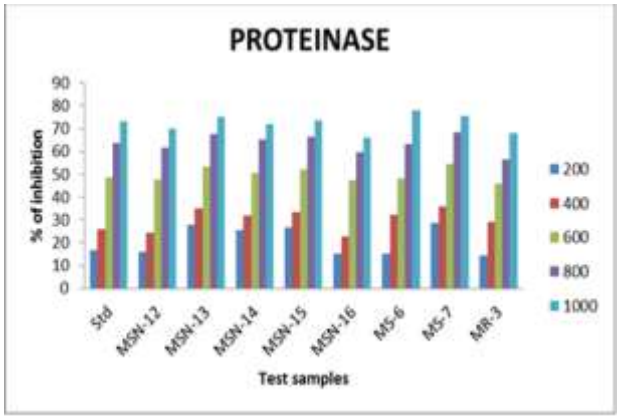
Percentage of inhibition for standard showed 23.68 % at 250 µg/ml and 84.26% at 1250 µg/ml concentration which is compared with the test compound which possess higher activity at 250 µg/ml and 1250 µg/ml concentration respectively. Therefore, the percentage of inhibition by test sample is higher than the standard drug (Graph 5). The IC 50 value of standard was 669.50 µg/ml.



Graph 6. Lipid per oxidation (Egg yolk) of test samples

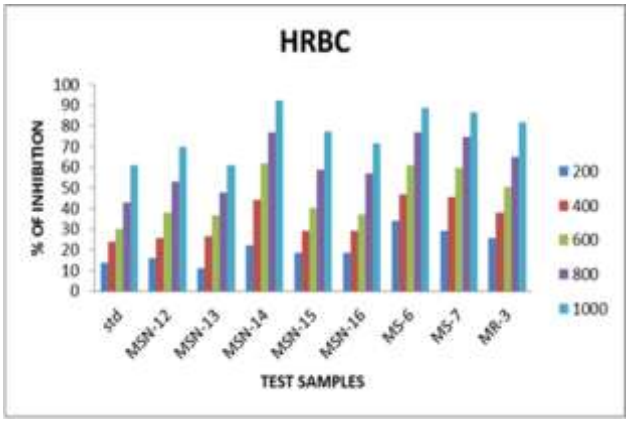
The LPO scavenging activity of test samples along with standard the concentration in the range of 250 – 1250µg/ml was shown in Graph 6. The similar activity was founded by Standard and MSN-12 i.e. 78.01 % and MSN-13 (80.52 %), MSN-15 (80.11 %) and MR-3 (80.27 %). When compared with standard the test compound MS-7 produced higher activity (92.89 %) and lower activity was gained by MSN-14 (68.96 %) and MSN-16 (68.15 %). The IC 50 values of both standard and test samples were calculated based on their percentage of inhibition.

3. In Vitro Anti-Inflammatory Activity



Graph 7. Proteinase inhibitory activity of test samples

Percentage of inhibition at concentration 250 µg/ml by proteinase inhibitory action of standard drug aspirin was founded to be 16.94 % when compared with test samples. At 250 µg/ml the percentage of inhibition by MSN-12, MSN-13, MSN- 14, MSN-15, MSN-16, MS-6, MS-7 and MR-3 was 15.90%, 28.12 %, 25.53 %, 26.63 %, 15.06 %, 15.19 %, 28.64 % and 14.61 % respectively. At concentration 1250 µg/ml, it was founded that the maximum activity was showed by MS-6 (77.83 %), MS-7 (75.50 %), MSN-13 (75.05 %), MSN-15 (73.56 %), MSN-14 (71.95 %) and MSN-12 (70.07 %) and lower activity was gained by MR-3 (67.87 %) and MSN-16 (66.06 %). The percentage of inhibition by standard was founded to be 73.37 which is similar to MSN-15 (Graph7).

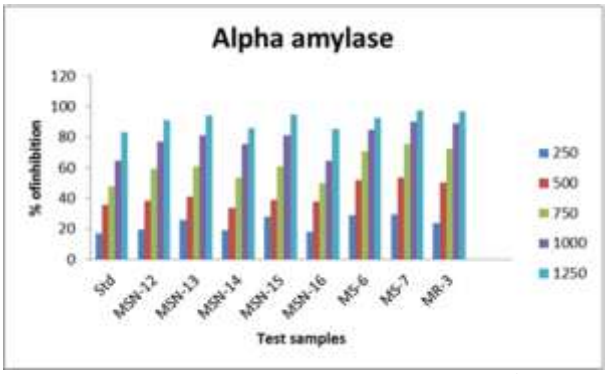


Graph 8. HRBC membrane stabilization test

Graph 8 represents HRBC membrane stabilization test of both standard drug Diclofenac and test compound. All the test samples MSN-12 (69.80 %), MSN-14 (92.31 %), MSN-15 (77.50 %), MSN-16 (71.64 %), MS-6 (89.03 %), MS-7 (86.74 %) and MR-3 (81.90 %) produce higher activity and MSN-13 (61.09 %) similar activity when compared with standard drug (61.16 %) at concentration 1000 µg/ml. And IC 50 values of both standard and test compound was recorded.

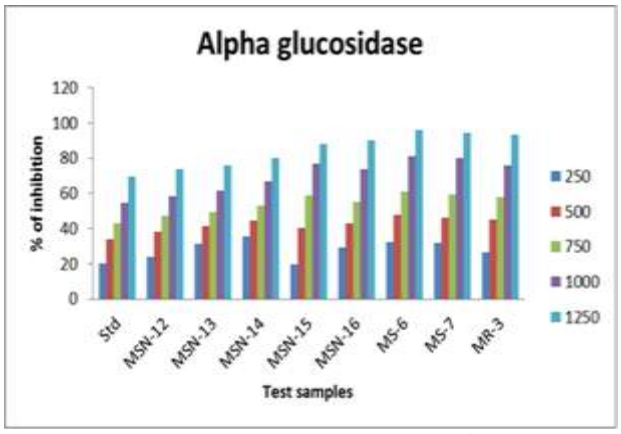
Monisha E, Suganya V, Anuradha V, and Syed Ali M, "Antioxidant, Anti-inflammatory and Antidiabetic Activity of Some Novel Chalcone and Piperidine Derivatives," *International Research Journal of Pharmacy and Medical Sciences (IRJPMS)*, Volume 2, Issue 1, pp. 6-12, 2018.

4. In Vitro Antidiabetic Activity



Graph 9. Alpha-amylase inhibitory activity (DNSA method) of test samples

When compared the standard and test compound, the maximum activity at 1000 µg/ml was exhibited by MS-7 (97.54 %) followed by MR-3 (96.62 %), MSN-15 (94.97 %), MSN-13 (94.46 %), MS-6 (92.72 %) and MSN-12 (91.08 %). MSN-14 (85.85 %) and MSN-16 (85.23 %) were found to be similar. Standard drug acarbose possessed inhibition of above 83.28 % at concentration 1250 µg/ml which is lower than that of all the test samples (Graph 9).



Graph 10. Alpha-glucosidase inhibitory activity of test samples

Alpha glucosidase inhibitory activity of test samples were higher than the standard drug acarbose i.e. 69.54 % at concentration 1250 µg/ml. Highest percentage was gained by MS-6 (95.78 %) and MS-7 (94.46 %) when compared with both standard and other test samples. All test compound possessed good alpha glucosidase inhibitory activity at different concentration in the range of 250 – 1250 µg/ml (Graph 10).

IV. DISCUSSION

Free radical scavenging is one of the best known mechanisms and offer rapid techniques for screening the radical scavenging activity (RSA) of specific compounds. Antioxidant activity is determined by the following methods such as DPPH, ABTS, FRAP, superoxide radical scavenging, hydroxyl radical scavenging, nitric oxide radical scavenging, etc.

The present study showed good antioxidant activity by the entire synthetic compound such as MSN-12, MSN-13, MSN-14, MSN-15, MSN-16, MS-6, MS-7 and MR-3 when compared with different standard drug. The DPPH radical scavenging assay is one of the best free radicals scavenging mechanism by which antioxidant inhibits the oxidation and offer a rapid technique for screening the radical scavenging activity of specific compounds. In the invitro study of novel furan/Benzofuran C-2 coupled quinolone hybrids the compounds 4c, 5b, 10c and 10f exhibited good radical scavenging potential compared with standard, ascorbic acid [21].

A series of five membered heterocyclics leading to the formation of 2-Aryl -5-furyl -1, 3, 4-oxadiazoles [DM (1-6)] was synthesised and tested for their antioxidant activity. All the compounds were screened for *in vitro* antioxidant activity by DPPH method and nitric oxide scavenging assay. Among the synthesized compounds DM-1, DM-2 and DM-4 were found to exhibit higher antioxidant activity [22].

The compounds **5a-d**-**8a-d** were evaluated for antioxidant property by 2,2'-diphenyl-1-picrylhydrazyl (DPPH), nitric oxide (NO), and hydrogen peroxide (H_2O_2) methods. Amongst the tested compounds 1,4-bis(*E*)-2-((arylmethanesulfonyl)-vinyl)benzenes (**5a-d**) were found to be potential antioxidant agents. This may be due to effective conjugation. On the other hand, the 1,4-(bis(3-arylmethanesulfonyl)-1*H*-pyrazol-4-yl)benzenes (**8a-d**) exhibited comparatively higher antioxidant activity than 1,4-(bis(3-arylmethanesulfonyl)-1*H*-pyrrol-4-yl)benzenes (**6a-d**). Thus, the compounds **5d** and **8d** showed excellent radical scavenging activity in all the three methods evaluated when compared with the standard ascorbic acid. It was also perceived that the compounds **5b**, **6d**, and **8b** exhibited good activity. However, the compound **7d** displayed least activity, whereas compounds **7a-c** showed no activity. The IC_{50} value of the standard drug ascorbic acid in DPPH method was found to be 59.65 at 100 µg mL^{-1} whereas IC_{50} values of the compounds **5d** and **8d** were found to be 56.45 and 57.08 µg mL^{-1}, respectively were reported by [23].

A series of nitrogen-containing heterocyclic compounds such as substituted 2,4,5-triaryl imidazole were synthesized by benzyl, ammonium acetate and aromatic/ heteroaromatic aldehyde, evaluated for their antioxidant activity by DPPH method. Among the screened compounds, electron rich imidazole exhibited significant antioxidant activities [24].

A novel series of 2-substituted 4,5-diphenyl imidazoles were synthesized and investigated for their antioxidant activity and membrane stabilization activity. 2,2-diphenyl-1-picrylhydrazyl (DPPH) radical assay was carried out to evaluate the antioxidant potential of the extract. The antioxidant activity of the synthesized compounds increased in a concentration dependent manner. In DPPH radical scavenging assay the IC50 value of the compounds ranged from 40 to 200µg/ml [25].

Bioactive novel imidazole derivatives have been synthesized under solvent free condition using molecular iodine as the catalyst and they are characterized. Their antioxidant potential were evaluated using different in vitro antioxidant models namely, DPPH radical, superoxide anion

Monisha E, Suganya V, Anuradha V, and Syed Ali M, "Antioxidant, Anti-inflammatory and Antidiabetic Activity of Some Novel Chalcone and Piperidine Derivatives," *International Research Journal of Pharmacy and Medical Sciences (IRJPMS)*, Volume 2, Issue 1, pp. 6-12, 2018.

and hydroxyl radical scavenging activities. The low IC 50 value may be due to the electron donating ability exerted by the methyl substituent. The 3.5-dimethylphenyl ring at C-2 of the imidazole ring has maximum DPPH and superoxide anion radical scavenging activities when compared with other imidazole derivatives [26].

Piperidine derivative demonstrated the highest scavenging capacity of 78% at 1000 µg/ml while demonstrated the least scavenging potential of 49% at 1000 µg/ml. This good activity of 8 have resulted from the presence of a methoxy group as a substation on C2 and C6 of the piperidine ring and the low activity displayed by 6 may have stemmed from the substitution of 4-cyanopheyl on C2 and C6 of the piperidine ring structure. Rutin exhibited an antioxidant potential of 99% at 1000 µg/mL which is higher than 5-10. The IC 50 values of all piperidine derivatives, 5-10 ranged between 584.8 - 959.69 µg/mL antioxidant activities. Test compounds containing specific substitutions groups, namely, Benzaldehyde (5 and 7), 4-cyano phenyl (6), 4-Methyl-3-trifluoromethylphenyl (9) and 4-chloro-2-flouro-4- iodophenyl (10) which is substituted on C2 and C6 of the piperidine ring as resulted in different levels of DPPH free radicals activity. The substitution of hydroxyl, methoxy, nitro and alkyl group on the piperidine ring revealed good antioxidant activities [27].

The membrane stabilization activity of the compounds was evaluated using human red blood cells (HRBC) membrane stabilization method. In a study, the concentration of 88.88 to 444.44µg/ml showed a dose dependent inhibition of haemolysis of erythrocytes induced by hypotonic solution [26].

A new series of 1,3,4-thiadiazole with pyrazole-3-carboxamides (**3a**–**f**) and pyrrole-3-carboxamide (**4a**–**f**) moiety are prepared using intermediate compounds 1,3,4-thiadiazolacrylamides (**2a**–**f**). The structures of newly synthesized compounds were confirmed on the basis of their ^{1}H NMR, ^{13}C NMR, LCMS mass, FT-IR and elemental analysis data results. Among all the compounds (12), seven compounds were found to exhibit significant anti-inflammatory activity with 77.27, 75.89, 76.24, 68.55, 63.72, 57.41, 53.05% and 81.00, 80.55, 78.62, 71.45, 68.95, 61.89, 56.32% inhibition in paw edema at 3 h and 5 h respectively, compared to the standard drug indomethacin (74.82 and 80.32% at 3 h and 5 h). Compounds **3c, 3d** and **4c** exhibited potent activity than standard drug [28].

A series of novel pyrazole-based chalcones have been designed, synthesized from1-methyl-5-(2,4,6-trimethoxyphenyl)-1*H*-pyrazole (**6**). All the synthesized compounds showed potential to demonstrate anti-inflammatory activities, of particular interest compounds **10i, 10e**, **10f**, and **10h** were found to be potent anti-inflammatory agents [29].

In the study of [30], results indicate that the 4-benzylpiperidine possess anti-inflammatory properties. The drug inhibited the heat induced albumin denaturation and proteinase inhibitory activity. It shows dose-dependent significant activity when compared with a standard drug. Hence, this study gives an idea that the 4-benzylpiperidine can be used as a lead compound for designing a potent anti-inflammatory drug which can be used to cure inflammation.

Retarding the absorption of glucose is one of the promising approaches for treating diabetes. In [31] study, the curcumin pyrazole series (3a-3e) exhibited hypoglycemic activities in the *in-vitro* models studied. The diaphragm is an important striated muscle tissue, which utilizes glucose from the blood and thus decreases blood glucose. All the compounds in the series shown to possess increased absorption of glucose and the action of insulin were also enhanced in the presence of curcumin pyrazoles. Among the curcumin pyrazole derivatives tested, compound 3b and 3a were found to be more effective in increasing the absorption of glucose. The enzyme alpha-amylase was inhibited by the curcumin pyrazole derivatives (3a-3e), out of which 3b was found to be more potent as that of curcumin. Compound 3a was also found to be an effective inhibitor of alpha-amylase activity. The activity of intestinal alpha-glucosidase and sucrase was also shown to inhibited by the series of compounds (3a-3e) tested. Compounds 3a and 3b exhibited significant inhibition, and the compound 3b was found to be a prominent inhibitor of the carbohydrate hydrolysing enzymes tested.

[32] Describes the synthesis, characterization of five newly synthesized Spiro- compounds characterized by means of chromatography, IR, 1H-NMR and Mass spectral analysis. The author carried in vitro anti-diabetic methods like alpha amylase and alpha glucosidase methods for anti-diabetic activity of tilted compounds. The investigation of anti-diabetic activity revealed that the test compounds of Spiro compounds showed favourable anti-diabetic activity. Among the titled compounds some were having potent antidiabetic activity.

Series of indoline derivatives were synthesized using N-(4-aminophenyl) indoline-1-carbothiamide as a precursor. The confirmation of synthesized compounds was done by 1H-NMR, 13C-NMR, LC-MS (ESI) and FT-IR. *In vitro* antidiabetic activity of synthesized indoline derivatives were examined by standard α-amylase inhibition assay. The compounds 4a (IC^{50} = 52.1 µg/mL) and 4b (IC^{50} = 57.7 µg/mL) showed potent α-amylase inhibition activity. The compounds 3a (IC^{50} = 62.2 µg/mL) and 3b (IC^{50} = 60.7 µg/mL) showed moderate antidiabetic activity [33].

V. CONCLUSION

The present study concludes that all the tested compounds belonging to chalcones and piperidines exhibit varying degree of antioxidant and free radical scavenging activity. The antioxidant activities are directly proportional to the percentage of scavenging capacity and inversely proportional to the IC50 value. The piperidine nucleus plays an important role in inhibition activity of test compounds and therefore it is highly significant in influencing the biological activities when compared to the chalcones. Future work should involve the determination quantitative structure activity relationship of the compounds with the bioactivity and insilico studies to predict the binding efficiencies of the test compounds with various anti-inflammatory and antidiabetic drug targets.

Monisha E, Suganya V, Anuradha V, and Syed Ali M, "Antioxidant, Anti-inflammatory and Antidiabetic Activity of Some Novel Chalcone and Piperidine Derivatives," *International Research Journal of Pharmacy and Medical Sciences (IRJPMS)*, Volume 2, Issue 1, pp. 6-12, 2018.

REFERENCES

[1] L. D. Högberg, A. Heddini and O. Cars. "The global need for effective antibiotics: challenges and recent advances". *Trends Pharmacol Sci*, vol. 31, pp. 509-515, 2010.

[2] L. Freire-Moran, B. Aronsson, C. Manz, I. C. Gyssens, A. D. So, D. L. Monnet, O. Cars, ECDC-EMAWorking Group. "Critical shortage of new antibiotics in development against multidrug-resistant bacteria – time to react is now! Drug Resist". *Updates*, vol. 14, pp. 118–124, 2011.

[3] V. Padmavathi, T. V. Reddy Ramana, K. Reddy Audisesha, A. Padmaja and D. Reddy Bhaskar. "A study on the reactivity of 1,3-dimethyl-2,6-diphenyl-4-piperidone: Synthesis of some novel hecterocycles". *Indian Journal of Chemistry*,vol. 44B, pp. 2527-2531, 2005.

[4] R. Aeluri, M. Alla, V. R. Bommena, R. Murthy and N. Jain. "Synthesis and Antiproliferative activity of polysubsituted Tetrahydropyridine and piperidin-4-one-3-caroxylate derivatives". *Asian Journal of Organic Chemistry*, vol. 1, pp. 71-79, 2012.

[5] P. Perumal, V. P. Pandey and Y. Lakshmi Sarayu, "Antimicrobial activity of 2, 6 di-substituted piperidine 4-one derivatives". *International Journal of Pharmacy and Pharmaceutical Sciences*, vol. 6, pp. 0975-1491, 2014.

[6] G. P. B. Maxime, "Synthesis of piperidine". *Tetrahedron*, vol. 60, pp. 1701-1779, 2004.

[7] R. J. Quellette. *Introduction to General Organic and Biological Chemistry*, New York, MacMillan Publishing Co, 1984.

[8] H. K. Hall. "Correlation of base strenghts of amines". *Journal of American Chemical Society*, vol. 79, pp. 5441- 5444, 1957.

[9] L.Sergeant and E. May**.** "Agonistsantagonists derived from desomorphine and metopon". *Journal of Medicinal Chemistry*, vol. 13, pp.1061, 1970.

[10] M. Misra, S. K. Pandey, V. P. Pandey, J. Pandey, R. Tripathi and R. P. Tripathi. "Organocatalyzed highly atom economic one pot synthesis of tetrahydropyridines as antimalarials". *Bioorganic and Medicinal Chemistry*, vol. 17, pp.625-633,2009.

[11] S. K. Reshmi, E. Sathya and P. Suganya Devi. **"**Isolation of piperdine from Piper nigrum and its antiproliferative activity". *African Journal of Pharmacy and Pharmacology*, vol. 4, pp. 1535-1546, 2010.

[12] M. G. Pizzuti, A. J. Minnaard and B. L. Feringa. **"**Catalytic asymmetric synthesis of alkaloid (+)-myrtine". *Organic Biomolecular Chemistry*, vol. 6, pp. 3464-3466, 2008**.**

[13] S. Balasubramaian, C. Ramalingan, G. Aridoss and S. Calvin. Synthesis and study of antibacterial and antifungal activities of novel 8-methyl-7,9-diaryl-1,2,4,8-tetraazaspiro[4.5]decan-thiones. *European Journal Medicinal Chemistry*, vol. 40, pp. 694-700, 2005.

[14] K. N. Venugopala, S. K. Nayak and O. Bharti. **"**Methyl 2,6-diphenyl-1-p-tolyl-4-(p-tolylamino)-1,2,5,6-tetrahydropyridine-3-carboxylate". *Acta Crystallographical.*, vol. E68. pp. 2392-2393, 2012.

[15] C. K. Atal, R. K. Dubey and J. Singh. "Biochemical basis of enhanced drug bioavailability by piperine: evidence that piperine is a potent inhibitor of drug metabolism". *The Journal Of Pharmacology And Experimental Therapeutics*, vol. 232, pp. 258-262, 1985.

[16] N. Butt. *Synthesis of biologically active piperidine based compound* Phd, University of Karachi, 2003.

[17] J. A. Colapret, G. Diamantidis, H. K. Spencer, T. C. Spaulding and F. G. Rudo. **"**Synthesis and pharmacological evaluation of 4,4-disubstituted piperidines". *Journal of Medicinal Chemistry*, vol. 32, pp. 968, 1989.

[18] V. Suganya, V. Anuradha, M. Syed Ali, P. Sangeetha, P. Bhuvana. "*In vitro* antioxidant activity of microencapsulated and non-encapsulated astaxanthin", *Asian Journal of Science and technology,* vol. 8, issue 11, pp. 6391-6404, 2017.

[19] V. Suganya, V. Anuradha, M. Syed Ali, P. Sangeetha, P. Bhuvana. "*In vitro* anti-inflammatory activity of microencapsulated and non-encapsulated astaxanthin". *International Journal of ChemTech Research*. vol. 10, issue10, pp. 186-195, 2017.

[20] V. Suganya, V. Anuradha, M. Syed Ali, P. Sangeetha, P. Bhuvana. "*In vitro* antidiabetic activity of microencapsulated and non-encapsulated astaxanthin". International Journal of Current Pharmaceutical Research. vol. 9, issue 5, pp. 90-96, 2017.

[21] A. Rajpurohit, N. D. Satyanarayan, S. Patil, K. M. Mahadevan and H. J. Adarsha. "*In vitro* antioxidant, antimicrobial and ADMET study of novel furan/Benzofuran C-2 coupled quinolone hybrids'. *International Journal of Pharmacy and Pharmaceutical Sciences*. vol. 9, issue 11, pp. 144-153, 2017.

[22] D. K. Mehta and R. Das. "Synthesis and *In vitro* antioxidant activity of some new 2,5, Disubstituted-1,3,4-oxadiazoles containing furan moiety". *International Journal of Pharmaceutical Sciences and Research*. pp. 2959-2963, 2011.

[23] G. Lavanya, V. Padmavathi and A. Padmaja. "Synthesis and antioxidant activity of 1,4-[bis(3-arylmethanesulfonyl pyrrolyl and pyrazolyl)]benzenes. Journal of the Brazilian Chemical Society". vol. 25 issue 7, pp. 1200-1207, 2014.

[24] P. Singh, R. Kumar, S. Tiwari, R. S. Khanna, A. K. Tewari and H. D. Khanna. "Docking, Synthesis and Evaluation of Antioxidant Activity of 2,4,5-Triaryl Imidazole". *Clinical & Medical Biochemistry: Open Access*. vol. 1, issue 1, pp. 1-4, 2015.

[25] G. Sam and A. Jerad Suresh A. "*In vitro* studies of antioxidant and membrane stabilization activity of 2-substituted 4,5-Diohenyl Imidazole derivatives". *American Journal of PharmaTech Research*. vol. 2 issue 4, pp. 643- 648, 2012.

[26] N. Srinivasan. "Antioxidant potential and antimicrobial screening of imidazole derivatives". *Journal of Biological and Scientific Opinion*. vol. 1 issue 3, pp. 157-167, 2013.

[27] A. Ravindernath and M. S. Reddy. "Synthesis and evaluation of antiinflammatory, antioxidant and antimicrobial activities of densely functionalized novel benzo [d] imidazolyl tetrahydropyridine carboxylates". *Arabian Journal of Chemistry*. 1-8, 2013.

[28] S. Maddila, S. Gorle, Ch. Sampath and P. Lavanya. "Synthesis and anti-inflammatory activity of some new 1,3,4-thiadiazoles containing pyrazole and pyrrole nucleus". *Journal of Saudi Chemical Society*. vol. 20, issue 1, pp. S306-S312, 2016.

[29] H. V. Chavan, L. K. Adsul, A. S. Kotmale, V.D. Dhakane and V. N. Thakare. "Design, synthesis, characterization and *in vitro* and *in vivo* anti-inflammatory evaluation of novel pyrazole-based chalcones". *Journal of Enzyme Inhibition and Medicinal Chemistry*. vol. 30 issue 1, pp. 22-31, 2015.

[30] V. Jayashree, S. Bgyalakhmi, K. Manjula devi and D. Richard daniel. "*In vitro* anti-inflammatory activity of 4-Benzylpiperidine". *Asian Journal of Pharmaceutical and Clinical Research.* vol. 9, issue 2, pp. 108-110, 2016.

[31] H. R. Puneeth and A. C. Sharada. "Antidiabetic effects of a series of curcumin pyrazoles *in-vitro". Asian Journal of Pharmaceutical and Clinical Research.* vol. 8, issue 6, pp. 146-149, 2015.

[32] K. Kishore Kumar, R. S. K. Shrama, P. Chanti Babu, M. Sreenivasa Rao, K. Durga Prasadu and D. Ravi Kumar. "Synthesis, characterization and pharmacological evaluation of novel spiro heterocyclic compounds as anti-diabetic agents". *Asian Journal of Research in Chemistry*. vol. 10, issue 3, pp. 393-398, 2017.

[33] D. Manoharan, K. Kulanthai, G. Sadhasivam, V. Raji and P. Thayumanavan. "Synthesis, characterization and evaluation of antidiabetic activity of novel indoline derivatives". *Bangladesh Journal of Pharmacology*. vol. 12: pp. 167-172, 2017.