International Journal of ChemTech Research
CODEN (USA): IJCRGG ISSN: 0974-4290
Vol.8, No.7, pp 363-372, 2015

Synthesis, Spectral and Conformational studies of some *N*-acyl-*t*(3)-methyl-r(2),*c*(6)-bis- (2'-furyl)piperidin-4-ones

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Abstract: The high resolution ^{1}H and ^{13}C NMR spectra of *N*-acyl-*t*(3)-isopropyl-r(2),*c*(6)-bis(2'-furyl)piperidin-4-ones **1-4** have been recorded at various temperatures and analyzed. The spectra reveal the presence of two rotameric forms (*E* and *Z*) in solution. ^{1}H-^{1}H COSY spectra was recorded at -30°C for **1-4** to assist the assignment of the signals for the *E* and *Z* isomers of **1- 4**. Coupling constants predict an equilibrium mixture of boat form **B1** and alternate chair form **CA** for **1-4**. The effect of varying the substituents at nitrogen on the ^{1}H and ^{13}C chemical shifts have been analysed in detail.
Keywords: NMR spectra, molecular conformation, *N*-acyl-piperidin-4-ones.

Introduction

Many piperidine derivatives are found to possess pharmacological activity[1,2] and form an essential part of the molecular structures of important drugs[3,4]. Recently attention has been focused on the application of the piperidone derivatives as prospective bio photonic materials[5,6]. Since the pharmacological properties and the reactivity depend on their stereochemistry, efforts were made for the development of new synthetic techniques leading to stereoselective piperidines and their characterization[7-10]. Most of the piperidine precursors are known to exist in chair conformation. Electron withdrawing groups (–NO, – CHO, –COR and –CONHPh) introduced at the nitrogen atom profoundly affect the conformations of the heterocyclic ring and orientation of the substituents in 2,6-dialkyl- and 2,6-diaryl substituted piperidines. Considerable work has been carried out on the conformations of several substituted 2,6- dialkyl- and 2,6-diarylpiperidine derivatives[11-17] in which severe $A^{1,3}$ strain exists in the normal chair conformation. In all these cases conformations which avoid $A^{1,3}$ strain are favoured. In an effort to create new derivatives of pharmacologically active piperidones, the present investigation was undertaken. So far only a few studies have been carried out on the conformation of piperidine derivatives in which a five membered ring is incorporated at 2 and 6 positions[18]. Jayabhrathi et al reported *N*-benzoyl-*t*(3)-isopropyl-r(2),*c*(6)-bis(2'-furyl)piperidin-4-one having antifungal and antibacterial activity[19].

Jayabharathi et al reported N-Nitroso-*t*(3)-alkyl r(2),*c*(6)-bis-2'-furyl piperidin-4-one oximes[20,21]. Manimekalai et al reported *N*-acyl-*t*(3)-isopropyl-r(2),*c*(6)-bis(2'-furyl)piperidin-4-one oxime derivatives[22]. The novel substituted furfurylidene piperidin-4-one derivatives may have promising applications in mycosis and other fungal infections[23]. In the present study *N*-acyl-*t*(3)-methyl-r(2),*c*(6)-bis(2'-furyl)piperidin-4-ones (**1-4**) synthesized and analyzed by ^{1}H, ^{13}C and ^{1}H-^{1}H COSY spectrum.

Results and Discussion

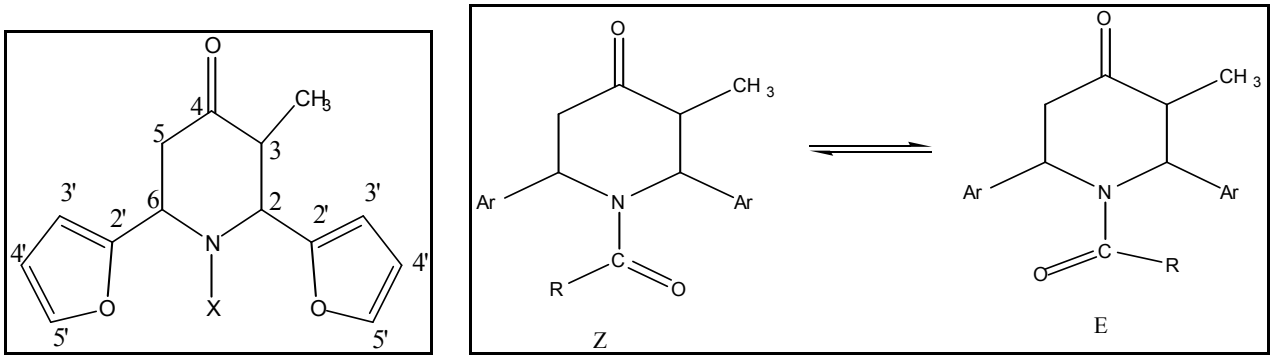
The high resolution ^{1}H and ^{13}C NMR spectra of *N*-formyl-*t*(3)-methyl-r(2),*c*(6)-bis(2'-furyl)piperidin-4-one1, *N*-acetyl-*t*(3)-methyl-r(2),*c*(6)-bis(2'-furyl)piperidin-4-one 2, *N*-propanoyl-*t*(3)-methyl-r(2),*c*(6)-bis(2'-furyl)piperidin-4-one 3 and *N*-benzoyl-*t*(3)-methyl-r(2),*c*(6)-bis(2'-furyl)pi peridin-4-one 4 have been recorded in $CDCl_3$ and analysed. The spectra were also recorded at low temperatures (+15, 0, -15 and -30ºC). The ^{1}H NMR spectra of *N*-acyl-*t*(3)-methyl derivatives 1-4 contained two distinct broad signals for each α-proton at RT and the signals are well resolved at low temperatures. ^{13}CNMR spectra also reveal the presence of two isomers in solution. The observation of two sets of signals in 1-4 suggests the presence of restricted rotation around N-C bonds and establishment of equilibrium between two rotamers with coplanar orientation of acyl group in these derivatives. The two rotamers are labelled as *Z* [carbonyl oxygen is *syn* to isopropyl group at C(3)] and *E* [carbonyl oxygen is *anti* to isopropyl group at C(3)] isomers (Figure 1).

Based on intensities, the signals for one rotamer can be easily differentiated from the other rotamer. The identification of proton signals in the *E* and *Z* isomers was done based on the results obtained in the ^{1}H-^{1}H COSY spectra recorded for 1-4. The assignment of the signals in ^{13}C NMR spectra have been made on the basis of known effects of alkyl and acyl substituents in six-membered rings[13b,15,25]. The chemical shifts and coupling constants derived from -30ºC NMR spectra are displayed in Table I. Table II reports ^{13}C chemical shifts of 1-4 recorded at -10ºC. The chemical shifts and coupling constants of parent piperidin-4-one i.e., *t*(3)-methyl-r(2),*c*(6)-bis(2'-furyl)piperidin-4-one are reported[24].

Ring Conformations

The coupling constants about C(2)-C(3) bond are drastically lower when compared with their parent piperidin-4-ones. The observation of only one coupling around 7 Hz about C(5)-C(6) bond (other coupling is very small) or total width of around 8-10 Hz for H(6) signal in 1-4. These coupling constants cannot be accounted by normal chair conformation (CE) with equatorial orientations of all the substituents. Moreover, in the normal chair conformation severe pseudoallylic ($A^{1,3}$) strain exists between *N*-acyl group and equatorial furfuryl rings at C(2) and C(6). In order to relieve $A^{1,3}$ strain, the *N*- acyl derivatives 1-4 may adopt alternate chair form or boat form. The possible conformations for the *Z* isomers of 1-4 are shown in Scheme I.

In conformations CE, B3 and B6 allylic strain exists between N-COR group and furfuryl rings and hence these conformations are ruled out in the present study. The conformation B2 is also not possible since in this conformation $J_{2,3}$ is expected to be around 10 Hz which is in contrast to the singlet observed for H(2) in 2-3 and the lower magnitude observed around 4 Hz in 1-4. Molecular mechanics calculations for several *N*-formyl-*trans*-3-alkyl-*cis*-2,6-diphenyl- piperidin-4-ones[25] have shown that the boat form B4 with alkyl group at flagpole position is having higher energy when compared to alternate chair form CA and boat forms B1 and B5. Therefore, in the present study, the boat conformation B4 is also excluded. In alternate chair form CA both couplings about C(5)- C(6) bond are expected to be around 3-4 Hz whereas in boat forms B1 and B5 they are expected to be around 10 and 4 Hz. The observation of one coupling around 7 Hz about C(5)-C(6) bond suggests that these compounds cannot exist in single conformation. They can exist as an equilibrium mixture of two or three conformers. In alternate chair form CA and boat form B5, *syn*-1,3 diaxial interaction exists between furfuryl groups at C(2) and C(6) whereas in boat form B1 such interaction is absent. Therefore, an equilibrium mixture of CA and boat form B5 is ruled out in the present study since in both the forms 1, 3 interactions are present. Moreover, an equilibrium mixture of boat forms B1 and B5 is also excluded in the present study based on the following observations.



X 1; CHO 2; $COCH_3$ 3; $COCH_2CH_3$ 4; COC_6H_5
Figure 1

Table-I ^{1}H Chemical shifts (ppm) of *N*-acyl-t(3)-isopropylpiperidin-4-ones 1-4

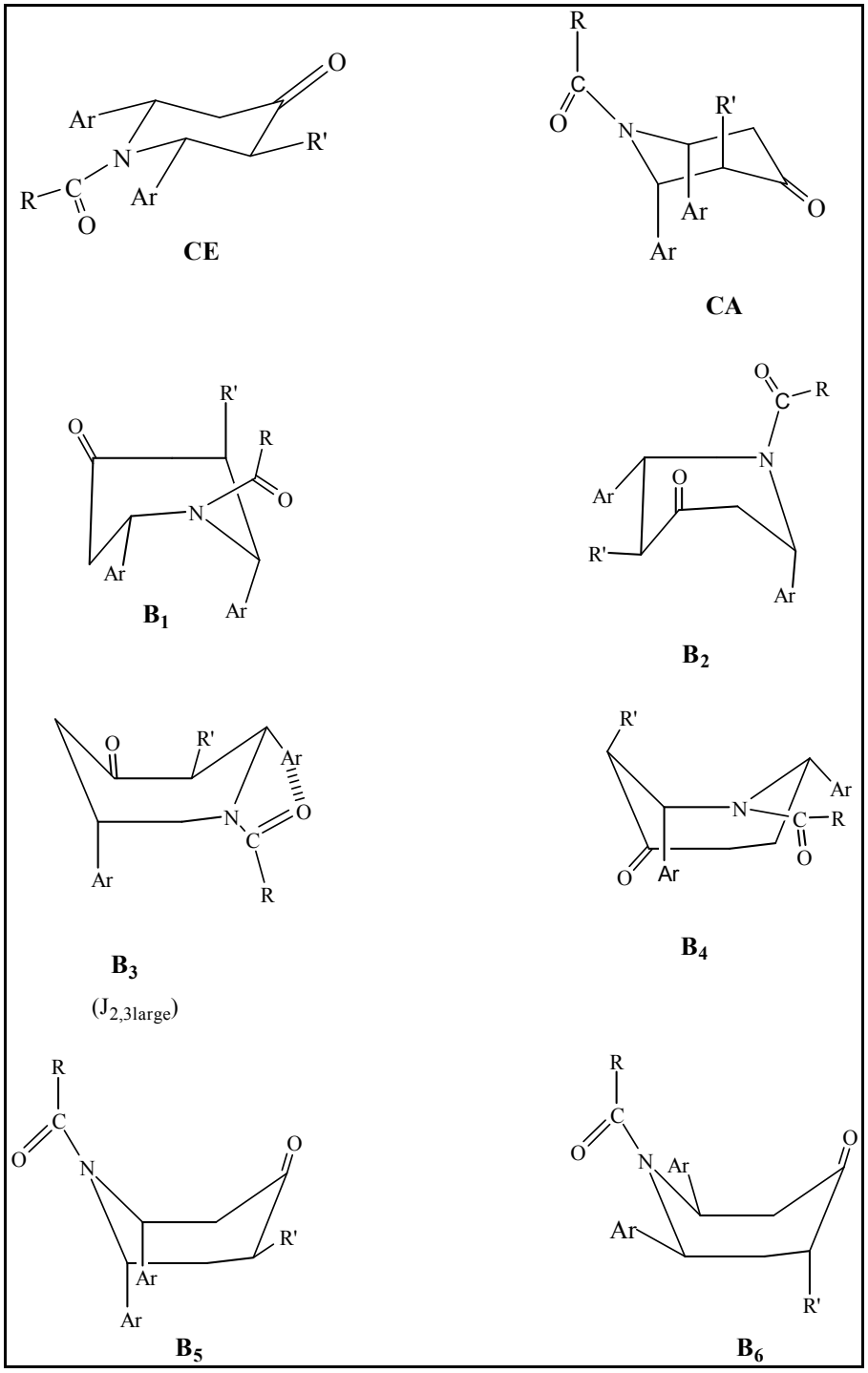
Compd	H(2)	H(3)	H(5)	H(6)	Alkyl protons	Acyl protons	Aromatic protons
1 E	4.77 (d,4.80)	3.18-3.22	2.95-2.97	6.04-6.06	1.25(d,7.09)	8.39	6.01(1H), 6.06-6.09(3H), 6.10(1H), 6.14(1H), 6.17(2H), 7.07(1H), 7.14(1H), 7.19(2H)
Z	5.61 (d,3.91)	3.18-3.22	3.01-3.03	5.19 (d,7.31)	1.27(d,7.11)	8.53	
2 E	5.05(s)	3.18-3.20	2.92 (t,27.97)	6.47 (d,7.72)	1.38(d,7.04)	2.42	5.86(1H), 5.97(3H), 6.11(3H), 6.17(1H), 7.07(1H), 7.13(2H), 7.20(1H)
Z	5.91(s)	3.18-3.20	2.98-3.05	5.52 (d,7.51)	1.28(d,7.01)	2.49	
3 E	5.08(s)	3.18-3.20	2.89-3.08	6.48 (d,6.86)	1.34(d,6.78)	1.24-1.27 (COCH2**CH3**) 2.63-2.77 (CO**CH_2**CH_3)	5.84(1H), 5.95(1H), 5.98(2H), 6.12(3H), 6.17(1H), 7.07(1H), 7.13(2H), 7.18(1H)
Z	5.92(s)	3.18-3.20	2.89-3.08	5.56 (d,6.23)	1.24-1.27	1.24-1.27 ($COCH_2$**CH_3**) 2.63-2.77 (CO**CH_2**CH_3)	
4 E	4.77 (d,4.80)	3.18-3.22	2.95-2.97	6.04-6.06	1.25(d,7.09)	8.39	6.01(1H), 6.14-6.16(4H), 6.20(1H), 6.27(1H), 7.15(1H), 7.19(2H), 7.28(1H), 7.68, 7.44-7.47(COC_6H_5)
Z	5.61 (d,3.91)	3.18-3.22	3.01-3.03	5.19 (d,7.31)	1.27(d,7.11)	8.53	

Table-II ^{13}C Chemical shifts (ppm) of *N*-acyl-t(3)-isopropylpiperidin-4-ones 1-4

Compd	C(2)	C(3)	C(4)	C(5)	C(6)	Alkyl carbons	Acyl carbons	Aromatic carbons
1 E	56.95	44.70	208.50	38.25	45.05	15.24	163.13	151.73, 151.36, 151.18, 150.51 C(2') and C(2") 142.84, 142.57, 142.15 142.09 C(5') and C(5") 110.58, 110.44, 110.31, 110.18 C(3') and C(3") 108.77, 107.92, 107.57 C(4') and C(4")
Z	50.95	44.70	208.50	38.92	51.17	15.57	163.23	
2 E	57.92	45.83	209.12	38.75	45.46	16.17	22.53 (CO**CH$_3$**) 171.63 (**CO**CH$_3$)	152.53, 152.00 C(2') and C(2") 110.61, 110.43 C(3') and C(3") 142.31, 142.07 C(2') and C(2") 108.07, 107.70 C(4') and C(4")
Z	51.19	45.00	209.12	39.24	52.53	15.83	22.53 (CO**CH$_3$**) 171.63 (**CO**CH$_3$)	
3 E	56.74	45.49	209.37	38.90	46.01	16.18	9.63 ($COCH_2CH_3$) 26.93 ($COCH_2CH_3$) 174.67 ($COCH_2CH_3$)	152.75, 152.35, 152.13 C(2') and C(2") 142.40, 142.24, 142.01, 141.90 C(5') and c(5") 110.59, 110.39, 110.26 C(3') and C(3") 108.07, 107.66 C(4') and C(4")
Z	52.73	45.07	209.37	29.35	50.01	15.76	9.63 ($COCH_2CH_3$) 26.93 ($COCH_2CH_3$) 174.43 ($COCH_2CH_3$)	
4 E	58.93	46.10	209.08	38.37	46.81	16.47	173.12	151.95 C(2') and C(2") 142.71, 142.05 C(5') and c(5") 135.44, 130.24, 128.84, 127.12 (CO**C$_6$H$_5$**) 110.62, 110.50 C(3') and C(3") 108.50, 108.10 C(4') and C(4")
Z	52.35	44.79	209.08	40.32	53.48	14.80	173.12	

The *trans* coupling about C(5)-C(6) bond in the boat forms B1 and B5 are expected to be around 10 and 4 Hz and the *cis* coupling are expected to be around 4 and 10 Hz respectively. An equilibrium mixture of boat forms B1 and B5 suggests that both couplings about C(5)-C(6) bond are expected to be almost the same and in the region 5-8 Hz. However, the observation of only one coupling around 7 Hz (the other coupling is of very small magnitude ≈1 Hz) ruled out the possibility of the existence of an equilibrium mixture of boat forms B1 and B5. Therefore, it is concluded that the *Z* isomers of *N*- acyl-3-methylpiperidin-4-ones 1-4 exist as an equilibrium mixture of boat form B1 and alternate chair form CA. Existence of such an equilibrium mixture suggests that one coupling should be small and another coupling should be around 6-8 Hz depending upon the population. The possible conformations for the *E* form of *N*-acyl-3-methyl- piperidin-4-ones 1-4 are shown in Scheme II.

The normal chair conformation **CE**, and the boat forms **B4** and **B6** are ruled out since in these conformations $A^{1,3}$ strain exists between acyl group and equatorial furfuryl groups. The observation of singlet for H(2) [coupling close to 0 Hz] ruled out the possibility of existing in boat conformations **B2** and **B3**. An equilibrium mixture of boat forms **B1** and **B5** for the *E* form of *N*-acyl-3-isopropyl- piperidin-4-ones is also ruled out based on the same arguments given for *Z* form. Therefore, it is concluded that the *E* isomers of **1-4** also exist as an equilibrium mixture of boat conformation **B1** and alternate chair form **CA** similar to *Z* forms of **1-4**.

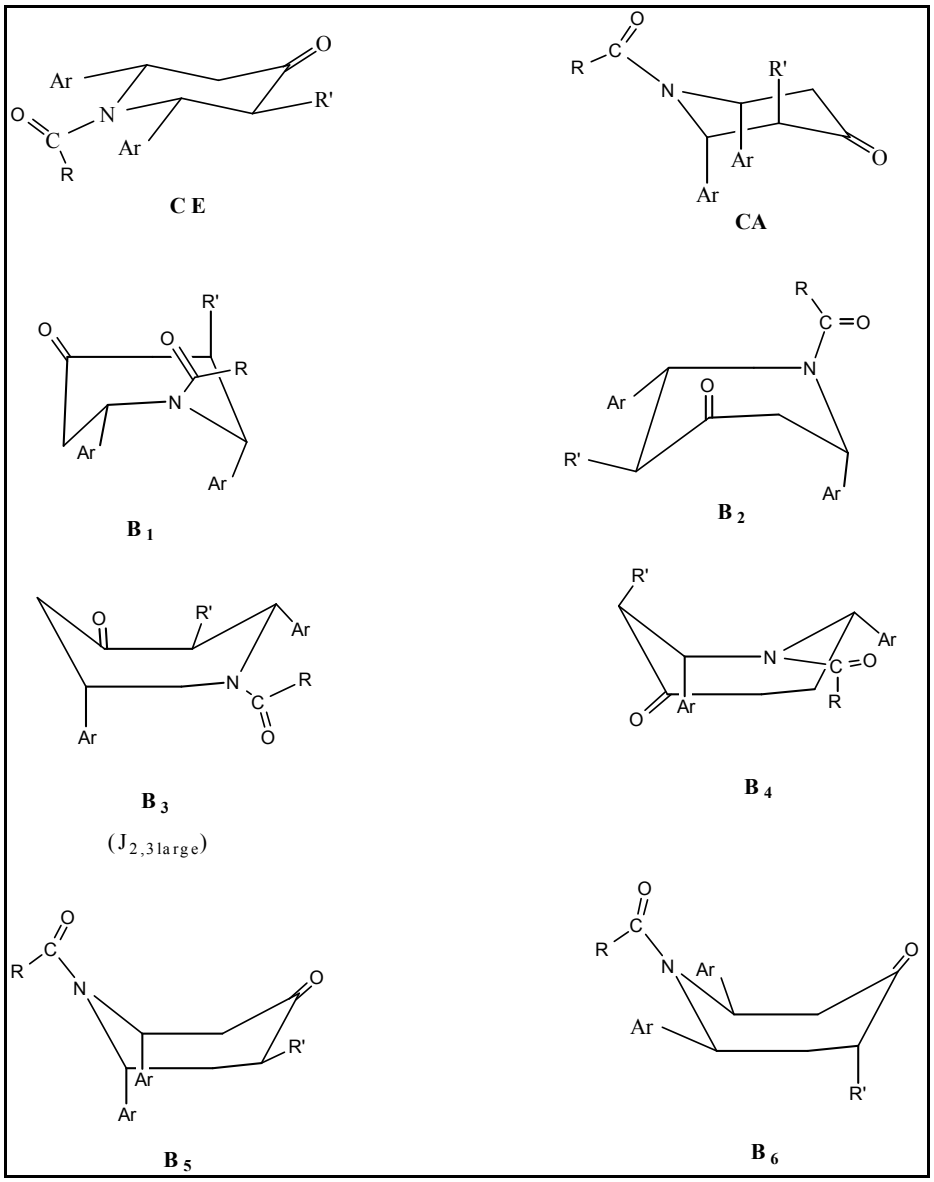


R = H, CH_3, C_2H_5 and C_6H_5

R^1 = CH 3

Ar = 2-furyl

Scheme I Possible conformations for the *Z*-isomers of 1-4



R = H, CH_3, C_2H_5 and C_6H_5

R^1 = CH_3

Ar = 2-furyl

Scheme II Possible conformations for the *E*-isomers of 1-4

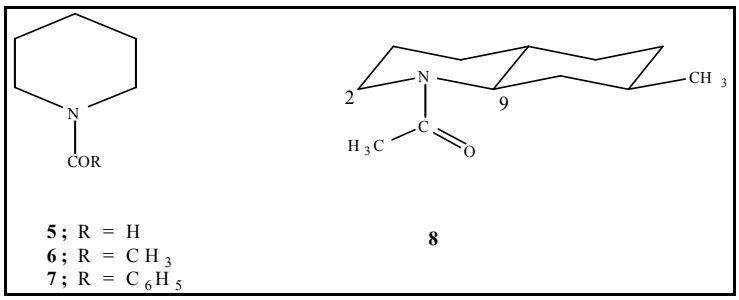
The torsional angles about C(5)-C(6) bond in **1-4** calculated according to Haasnoot equation[26] are in the range 135ºCand these values are abnormally lower than the ø*trans* values expected in the normal chair conformation (180ºC) and in the boat conformation **B1** (180ºC). Simple distortion cannotdecrease the torsional angle from 180ºCto 135ºCand therefore, torsional angle calculations also suggest the presence of additional conformer *i.e.,* **CA** in equilibrium with the boat form **B1** for **1-4**.

Analysis of Chemical Shifts

To determine the effect due to *N*-acylation on ^{1}H chemical shifts of α protons in normal chair conformation the chemical shifts of *N*-formylpiperidine **5** (Ref. 27), *N*-acetyl- and *N*-benzoyl-3-methylpiperidines **6** and **7** (Ref. 28) (exists in two rotameric forms) and *N*-acetyl-*t*(7)-methyldecahydroquinoline **8** (Ref. 29) are compared with their corresponding parent compounds *i.e.,* piperidine, 3-methylpiperidine and *t*(7)-methyldecahydroquinoline. From the comparison, it is seen that in normal chair conformation the *anti* α protons (*anti* to –N-C=O bond) are deshielded to an extent of ≈ 0.6 ppm (equatorial) and ≈0.4 ppm (axial) and the *syn* equatorial α protons are deshielded to an extent of ≈1.3-1.4 ppm due to *N*-acylation. There is slight

deshielding on the *syn* axial proton if equatorial hydrogen is attached to *syn* α carbon whereas the presence of equatorial alkyl group causes the *syn* axial proton to experience a deshielding magnitude of 1.2 ppm due to *N*-acylation.

The effects observed due to *N*-acylation in **1-4** are displayed in **Table III**. The deshielding magnitude observed on H(2) in the *Z* isomers (*syn* α protons) are roughly same as those observed on H(6) in the *E* isomers (*syn* α protons) and the magnitude of deshielding is ≈ 2 ppm in **1-4**. This is considerably higher than the magnitude observed for *syn* α axial protons in the normal chair conformation. Moreover, the deshielding magnitude observed on *anti* α protons [H(2) in the *E* isomer and H(6) in the *Z* isomer] is also higher (≈ 1 ppm) compared to the *anti* α axial protons in the normal chair conformation. Thus, the observed deshielding of α protons are inconsistent with the normal chair conformation **CE** thus supporting an equilibrium mixture of boat conformation **B1** and alternate chair form **CA** for **1-4.** In these conformations the *syn* α protons lie in the same plane of the N-C=O moiety and hence experience greater deshielding due to steric and magnetic anisotropic effect of N-C=O bond. The *anti* α protons are also closer to the plane of the N-C=O moiety and hence expected to experience greater magnetic anisotropic effect of the N-C=O moiety. It is also seen that replacement of *N*-formyl group by other *N*-acyl group (acyl = acetyl, propanoyl and benzoyl) increases the deshielding magnitude observed on the α protons due to *N*-acylation and the deshielding magnitude is roughly the same and independent of the nature of the R group of NCOR moiety in the *N*-acyl derivatives **2-4**.



5; R = H
6; R = CH_3
7; R = C_6H_5

8

Table-III Observed deshielding magnitude (ppm) in *N*-acylpiperidin-4-one derivatives 1-4

Compd		H(2)	H(3)	H(5)	H(6)	Alkyl protons
1	E	+0.97	+(0.30-0.41)	+(0.07-0.16) +(0.23-0.25)	+(1.87-1.89)	+0.33
	Z	+1.81	+(0.30-0.41)	+(0.13-0.22) +(0.29-0.31)	+1.08	+0.35
2	E	+1.25	+(0.30-0.39)	+(0.04-0.11) +(0.26-0.33)	+2.30	+0.46
	Z	+2.11	+(0.30-0.39)	+(0.24-0.31) +(0.26-0.33)	+1.35	+0.36
3	E	+1.28	+(0.30-0.39)	+(0.01-0.27) +(0.17-0.36)	+2.31	+0.42
	Z	+2.12	+(0.30-0.39)	+(0.01-0.27) +(0.17-0.36)	+1.39	+(0.32-0.35)
4	E	+1.33	+(0.16-0.32)	+(0.16-0.32) +(0.21-0.24)	+2.32	+0.39(CH_3)
	Z	+2.04	+(0.45-0.52)	+(0.05-0.15) +(0.21-0.24)	+1.31	+0.32(CH_3)

Comparison of the chemical shifts of β protons in *N*- formylpiperidine [1.55 ppm (*syn*); 1.59 ppm (*anti*)][27] and *N*-acetylpiperidine (1.52 ppm)[30] with piperidine (1.46 ppm) reveals that there is no appreciable change in the chemical shifts of β protons due to *N*-acylation in normal chair conformation. Thus, it appears that in cases where there is no conformational change due to *N*-acylation the chemical shifts of β hydrogens are not expected to be altered significantly due to *N*-acylation. The deshielding magnitude observed on H(3) and one of the methylene protons at C-5 in N-acyl-3-methyl derivatives are probably due to the different conformations of these N-acyl derivatives.

With a view to determine the ^{13}C substituent parameters of the formyl, acetyl and benzoyl substituents at nitrogen in the normal chair conformation **CE** of the six-membered ring compounds, the chemical shifts of *N*-formylpiperidine[27], *N*-acetylpiperidine[31] and *N*-benzoylpiperidine[32] are compared with that of the parent piperidine and the parameters are displayed in **Table IV**. It is seen from **Table IV** that *syn* α carbons are shielded to the extent of 5-7 ppm due to *N*-acylation in normal chair conformation **CE**. The shielding observed on *anti* α, *syn* β, *anti* β and γ carbons appears to be very small (≈ 1-3 ppm) in normal chair conformation. The shielding magnitude observed due to *N*-acylation in **1-4** are also displayed in **Table IV**.

Table IV reveals that the shielding values observed on α carbons [C(2) and C(6)] in **1-4** and C(5) [β carbon] are considerably higher than the values observed in normal chair conformation **CE** and lower than the values observed in the alternate chair conformation **CA**. The magnitude of shielding observed on β carbon *i.e.,*

Table-IV- Observed shielding magnitude (ppm) of some simple N-acylpiperidines and N-acylpiperidin-4-one derivatives 1-4

Compd	**α**		**β**		**γ**
	syn	anti	syn	anti	
N-Formylpiperidine	40.57 (-7.33)	46.76 (-1.14)	26.66 (-1.24)	24.75 (-3.15)	25.16 (-1.04)
N-Acetylpiperidine	41.58 (-6.32)	46.66 (-1.24)	25.29 (-2.61)	26.08 (-1.82)	24.12 (-2.08)
N-Benzoylpiperidine	42.60 (-5.30)	26.11 (-1.79)	24.60 (-1.60)	26.11 (-1.79)	48.30 (+0.40)
Piperidine	47.90		27.90		26.20

		C(2)	C(3)	C(4)	C(5)	C(6)	Methyl group
1	E	-3.67	-4.81	+0.53	-8.10	-8.92	+5.10
	Z	-9.67	-4.81	+0.53	-7.43	-2.80	+5.43
2	E	-2.70	-3.68	+1.15	-7.60	-8.51	+6.03
	Z	-9.43	-4.51	+1.15	-7.11	-1.44	+5.69
3	E	-3.88	-4.02	+1.40	-7.45	-7.96	+6.04
	Z	-7.89	-4.44	+1.40	-7.00	-3.96	+5.62
4	E	-2.23	-3.41	+1.11	-7.98	-7.16	+6.33
	Z	-8.27	-4.72	+1.11	-6.03	-0.49	+4.66

C(3) is considerably lower than that observed on C(5) indicating different conformation of methyl group at C(3) in *N*-acyl-3-methyl derivatives **1-4** compared to their corresponding parent 3-methyl- piperidin-4-one. For methyl group and C(4) carbons considerable deshielding has been observed due to *N*-acylation which also supports conformation other than normal chair conformation **CE** *i.e.,* an equilibrium mixture of boat conformation B1 and alternate chair conformation **CA** for these *N*- acyl-3-methyl derivatives **1-4**.

Comparison of shielding magnitude observed on *syn* α carbons [C(2) in *Z* isomer and C(6) in *E* isomer] and *anti* α carbons [C(6) in *Z* isomer and C(2) in *E* isomer] reveals the following order.

N-Formyl > *N*-acetyl > *N*-propanoyl > *N*-benzoyl (*syn* α carbon) *N*-Benzoyl < *N*-formyl ≈ *N*-acetyl < *N*-propanoyl (*anti* α carbon).

The bulky *N*-propanoyl group causes higher shielding magnitude on the nearby α carbon which lies on the same side of the ethyl group of the propanoyl moiety compared to other acyl groups of N-COR moiety.

Experimental Section

^{1}H and ^{13}C NMR spectra were recorded on a Bruker AMX 400 NMR spectrometer operating at 400

and 100.6 MHz for ^{1}H and ^{13}C respectively. The ^{1}H- ^{1}H COSY spectra were recorded on a Bruker DRX 500 NMR spectrometer using standard parameters. Solutions were prepared by dissolving 10 mg (^{1}H) and 50 mg (^{13}C) of the compound in 0.5 mL of solvent ($CDCl_3$). All NMR measurements were made in 5 mm NMR tubes.

The parent compound *t*(3)-methyl-r(2),*c*(6)-bis(2'- furyl)piperidin-4-one was prepared according to the procedure described for the preparation of 2,6- diarylpiperidin-4-ones reported by Noller and Baliah[33]. A mixture of ammonium acetate (0.05 mol), furfuraldehyde (0.1 mol) and butane-2-one (0.05 mol) in distilled ethanol was heated first to boiling and thenstirred under cold condition for 1 hr. To the viscous liquid obtained ether (200 mL) and concentrated hydrochloric acid (20 mL) were added. The precipitated hydrochloride was removed by filtrationand washed first with 40 mL mixture of ethanol and ether (1:1) and then with ether to remove most of the coloured impurities. The base was liberated from an alcoholic solution by the addition of aqueous ammonia followed by dilution with water. It was recrystallised twice from benzene-petroleum ether mixture. Yield:70% m.p.40ºC.

The *N*-formyl derivative **1** was prepared from parent piperidin-4-one by adopting the general procedure described in the literature[25]. Formic acid (85%, 5 mL) was added slowly to cold acetic anhydride (10 mL) kept at about 5ºC in a 50 mL round bottomed flask. After the addition was over, the mixture was heated to 60ºC and then maintained at 50-60ºC for 1 hr. The solution was then cooled to 5ºC and added dropwise to a cold solution of the parent piperidone (5 mmol) in dry benzene (50 mL) taken in a 250 mL round bottomed flask. The reaction mixture was stirred at 25ºC for 8 hr after which it was poured into water. The organic layer was separated and dried over anhydrous sodium sulphate, partially concentrated and left for crystallisation. The crystals thus separated were purified by recrystallization from petroleum ether. Yield: 80%, m.p. 35ºC.

The other *N*-acyl derivatives **2-4** were prepared by following the procedures reported in literature[34]. Equimolar amounts of acetic anhydride/ propanoic anhydride/benzoyl chloride (0.01 mol), parent piperidone (0.01 mol) and triethylamine in benzene (50 mL) were refluxed for 4-10 hr. The progress of reaction was monitored by TLC. The precipitated ammonium salt was filtered off, the organic layer was washed with 2N HCl followed by water and then the solvent removed at low pressure. The *N*- acylpiperidones **2-4** obtained were purified by recrystallization from petroleum ether. **2**: Yield:70%, m.p. 140ºC **3:** Yield: 75%; m.p. 130ºC.

4: Yield: 72%; m.p. 154ºC.

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