Chemistry of Heterocyclic Compounds, Vol. 43, No. 7, 2007

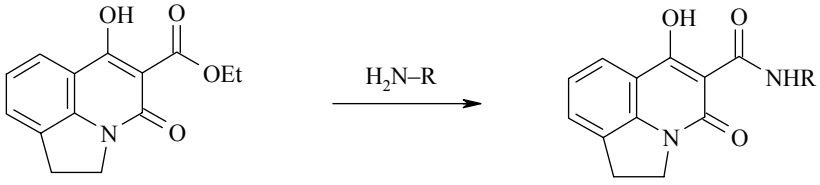
4-HYDROXY-2-QUINOLONES 121.* SYNTHESIS AND BIOLOGICAL PROPERTIES OF 1-HYDROXY-3-OXO-5,6-DIHYDRO-3H-PYRROLO[3,2,1-*ij*]QUINOLINE-2-CARBOXYLIC ACID ALKYLAMIDES

I. V. Ukrainets, N. L. Bereznyakova, and E. V. Mospanova

A simple method is proposed for preparing 1-hydroxy-3-oxo-5,6-dihydro-3H-pyrrolo[3,2,1-ij]-quinoline-2-carboxylic acid alkylamides. For the case of the secondary butylamide features of the steric structure of the synthesized compounds is discussed. The results of a study of their anti-inflammatory and diuretic activities are presented.

Keywords: alkylamides, 4-hydroxy-2-oxoquinoline-3-carboxylic acids, diuretic activity, anti-inflammatory activity, X-ray structural analysis.

For transformation of ethyl 1-hydroxy-3-oxo-5,6-dihydro-3H-pyrrolo[3,2,1-*ij*]quinoline-2-carboxylates (**1**) to alkyl-, aryl-, or hetarylamides (of interest as potentially biologically active materials) it was proposed to treat them with a 40% excess of the corresponding amine in refluxing bromobenzene over 20 h with subsequent distillation of solvent at reduced pressure and purification of the final reaction products [2]. At the same time, the high reactivity of 1-R-3-ethoxycarbonyl-4-hydroxy-2-oxo-1,2-dihydroquinolines has been noted and this allows them to be amidated quite efficiently [3-5]. The obvious structural similarity of ester **1** with these compounds led us to suggest that they will react with amines (at least aliphatic) under milder conditions.



1 **2a–q**

2 a R = Me, **b** R = Et, **c** R = All, **d** R = Pr, **e** R = *i*-Pr, **f** R = Bu, **g** R = *i*-Bu, **h** R = *sec*-Bu, **i** R = C_5H_{11}, **j** R = *i*- C_5H_{11}, **k** R = 2-hydroxyethyl, **l** R = 3-hydroxypropyl, **m** R = *cyclo*-C_3H_5, **n** R = *cyclo*-C_5H_9, **o** R = *cyclo*-C_6H_{11}, **p** R = *cyclo*-C_7H_{13}, **q** R = adamant-1-yl

* For Communication 120 see [1].

National University of Pharmacy, Kharkiv 61002, Ukraine; e-mail: uiv@kharkov.ua. Translated from Khimiya Geterotsiklicheskikh Soedinenii, No. 7, pp. 1015-1022, July, 2007. Original article submitted March 27, 2006.

This proposal was fully confirmed experimentally. It was found that the transformation of ester **1** to the 1-hydroxy-3-oxo-5,6-dihydro-3H-pyrrolo[3,2,1-*ij*]quinoline-2-carboxylic acid alkylamides **2a-q** occurs readily in refluxing ethanol and even at room temperature with gaseous amines, being complete after 2-3 h in most cases. It should also be noted that a 40% excess of the amine is not mandatory since complete amidation is normally accomplished for analogous reactions with a 10% excess.

Hence this method allows not only a significant simplification of the separation of the target compounds via their high yields but also a marked shortening of the reaction time and consumption of amine thus recommending it as a preparative method.

All of the obtained amides **2a-q** (Table 1) are colorless, crystalline substances soluble in DMF and DMSO but virtually insoluble in water. Their structure was confirmed from ^{1}H NMR spectroscopy (Table 2). In the case of the *sec*-butylamide **2h** it was further proved by X-ray structural analysis (Figure 1, Tables 3, 4) which showed that the tricyclic fragment and the $O_{(2)}$, $C_{(12)}$, $O_{(3)}$, $N_{(2)}$, $O_{(1)}$ atoms lie in a single plane to an accuracy of 0.01 Å. This is likely due to the presence of two intramolecular hydrogen bonds as $O_{(2)}$–$H_{(2)}$···$O_{(3)}$ (H···O 1.70 Å, O–H···O 149º) and $N_{(2)}$–$H_{(2N)}$···$O_{(1)}$ (H···O 1.96 Å, N–H···O 135º) leading to a marked lengthening of the bonds $O_{(1)}$–$C_{(9)}$ 1.242(2) and $O_{(3)}$–$C_{(12)}$ 1.262(2) Å when compared with their mean value of 1.210 Å [6]. The $C_{(7)}$–$C_{(8)}$ bond 1.382(3) Å is also lengthened when compared with its mean value of 1.326 Å which is characteristic of quinolone compounds. The secondary butyl group on the $N_{(2)}$ atom is randomized in two positions (**A** and **B**) as a result of rotation about the $C_{(12)}$–$N_{(2)}$ bond with a population density **A:B** = 59:41% and has a conformation

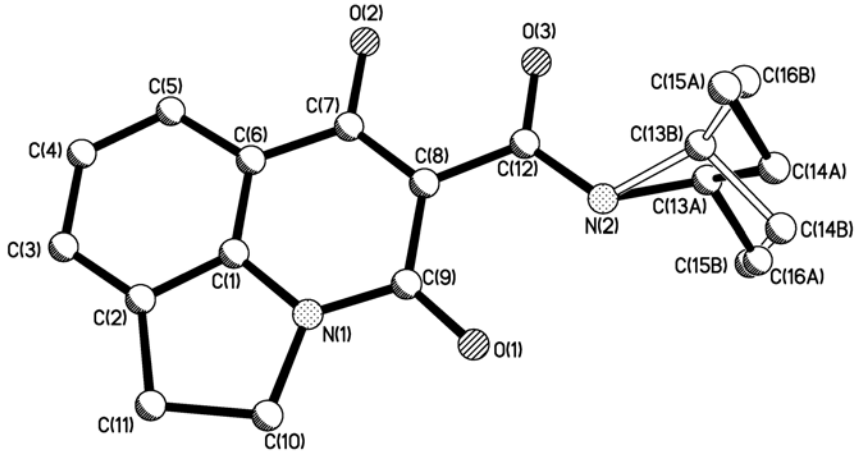


Fig. 1. Structure of the *sec*-butylamide molecule **2h** with atomic numbering.

close to ap relative to the $C_{(8)}$–$C_{(12)}$ bond (torsional angle $C_{(13)}N_{(2)}C_{(12)}C_{(8)}$ 165.9(2)º in conformer **A** and -157.4(3)º in **B**). The methyl group of this substituent in conformer **A** occurs in the -*ac*-conformation and in **B** in a +*sc*-conformation relative to the $C_{(12)}$–$N_{(2)}$ bond (torsional angles $C_{(12)}N_{(2)}C_{(13)}C_{(16)}$ -123.4(4)º in **A** and 78.8(8)º for **B**). The ethyl group is found in +*ac* -and -*ac*-conformations relative to the $C_{(12)}$–$N_{(2)}$ bond in **A** and **B** respectively and is twisted relative to the $N_{(2)}$–$C_{(13)}$ bond (torsional angles $C_{(12)}N_{(2)}C_{(13)}C_{(14)}$ 120.9(4)º in **A** and -158.3(4)º in **B**, $N_{(2)}C_{(13}C_{(14)}C_{(15)}$ -49.2(5)º in **A** and 54.8(9)º in **B**). A shortening occurs for the intramolecular contacts $H_{(13b)}$···$O_{3)}$ 2.39 (sum of van der Waal radii 2.46 [7]), $H_{(14a)}$···$N_{(2)}$ 2.64 (2.67), $H_{(14d)}$···$N_{(2)}$ 2.59 (2.67), $H_{(15b)}$···$N_{(2)}$ 2.40 (2.67), $H_{(15f)}$···$N_{(2)}$ 2.18 (2.67), and $H_{(15f)}$···$H_{(2nb)}$ 1.92 Å (2.34 Å).

The theoretical basis for studying the anti-inflammatory properties of the compounds synthesized by us relates to the ability of the near in structure 4-hydroxy-2-oxo-1,2-dihydroquinoline-3-carboxamides to actively suppress the inflammatory reaction of an organism to the introduction of carrageenin [8]. The study was carried

TABLE 1. Parameters for the 1-Hydroxy-3-oxo-5,6-dihydro-3H-pyrrolo[3,2,1-*ij*]quinoline-2-carboxylic Acid Alkylamides **2a-q***

Compound	Empirical formula	Found, % / Calculated, %			mp, °C (ethanol)	Yield, %	PA,*[2] %	DA,*[3] %
		C	H	N				
2a	$C_{13}H_{12}N_2O_3$	63.93 / 63.81	4.95 / 4.86	11.47 / 11.55	187-189	94	1.6	63
2b	$C_{14}H_{14}N_2O_3$	65.11 / 65.20	5.46 / 5.58	10.85 / 10.77	143-145	95	51.6	125
2c	$C_{15}H_{14}N_2O_3$	66.66 / 66.53	5.22 / 5.14	10.36 / 10.42	116-118	93	0	88
2d	$C_{15}H_{16}N_2O_3$	66.16 / 66.29	5.92 / 5.84	10.29 / 10.19	88-90	88	13.3	63
2e	$C_{15}H_{16}N_2O_3$	66.16 / 66.11	5.92 / 5.96	10.29 / 10.20	161-163	76	20.0	100
2f	$C_{16}H_{18}N_2O_3$	67.12 / 67.25	6.34 / 6.46	9.78 / 9.86	84-86	85	-7.5	113
2g	$C_{16}H_{18}N_2O_3$	67.12 / 67.27	6.34 / 6.45	9.78 / 9.90	133-135	87	15.8	112
2h	$C_{16}H_{18}N_2O_3$	67.12 / 67.04	6.34 / 6.22	9.78 / 9.69	176-178	75	-13.3	63
2i	$C_{17}H_{20}N_2O_3$	67.98 / 67.85	6.71 / 6.65	9.33 / 9.26	81-83	83	5.8	75
2j	$C_{17}H_{20}N_2O_3$	67.98 / 67.89	6.71 / 6.67	9.33 / 9.39	118-120	86	6.6	88
2k	$C_{14}H_{14}N_2O_4$	61.31 / 61.40	5.14 / 5.26	10.21 / 10.12	159-161	91	24.1	75
2l	$C_{15}H_{16}N_2O_4$	62.49 / 62.40	5.59 / 5.51	9.72 / 9.88	133-135	85	10.8	100
2m	$C_{15}H_{14}N_2O_3$	66.66 / 66.75	5.22 / 5.31	10.36 / 10.26	166-168	78	9.1	100
2n	$C_{17}H_{18}N_2O_3$	68.44 / 68.38	6.08 / 6.00	9.39 / 9.33	176-178	83	2.5	150
2o	$C_{18}H_{20}N_2O_3$	69.21 / 69.28	6.45 / 6.56	8.97 / 8.85	202-204	86	-3.3	63
2p	$C_{19}H_{22}N_2O_3$	69.92 / 69.99	6.79 / 6.87	8.58 / 8.64	170-172	80	15.8	67
2q	$C_{22}H_{24}N_2O_3$	72.51 / 72.43	6.64 / 6.55	7.69 / 7.78	252-254	74	-28.3	113

* *Voltaren*: PA = -42.5, DA absent. *Furosemid*: PA absent, DA = 188.
*[2] PA is the anti-inflammatory activity; a "-" indicates inhibition of edema and a "+" an increase in edema.
*[3] DA is the diuretic activity.

out by a known method [9] on white, non pedigree rats of weight 180-200 g on the carrageenin edema model. Inflammation was brought about by subplantar introduction of 0.1 ml of a 1% aqueous carrageenin suspension into one hind leg. Amides **2a-q** were introduced intragastrically as a fine aqueous suspension stabilized by Tween-80 at a dose of 8 mg/kg (correlating with an effective dose of *voltaren*) at one hour before the carrageenin injection. The effect of the compound introduced was determined oncometrically after 2 h (maximum edema growth caused by the carrageenin). From the experimental data presented in Table 1 it can been seen that only the adamant-1-yl amide **2q** activity is pronounced, although inferior in antiexudate activity to *voltaren*. The remaining compounds either show almost no effect or, in the case of the ethylamide **2b**, proved to increase the inflammatory effect.

The effect of the amides **2a-q** on the urinary function of the kidney was studied by the Taylor and Topliss method [10] on white, non pedigree rats of weight 180-200 g. All of the animals were give an aqueous

TABLE 2. ^{1}H NMR Spectra of Compounds **2a-q**

Compound	Chemical shifts, δ, ppm (*J*, Hz)							
	1-OH (1H, s)	NH (1H)	Pirroloquinoline ring					R
			H-9 (1H, d)	H-7 (1H, d)	H-8 (1H, t)	5-CH_2 (2H, t)	6-CH_2 (2H, t)	
2a	17.20	10.11 (q, *J* = 4.2)	7.71 (*J* = 8.2)	7.41 (*J* = 7.3)	7.13 (*J* = 7.5)	4.34 (*J* = 7.9)	3.42 (*J* = 8.1)	2.99 (3H, d, *J* = 4.8, CH_3)
2b	17.26	10.23 (t, *J* = 5.3)	7.69 (*J* = 8.0)	7.43 (*J* = 7.0)	7.14 (*J* = 7.5)	4.32 (*J* = 8.2)	3.41 (*J* = 8.2)	3.45 (2H, q, *J* = 6.2, $C\underline{H}_2CH_3$); 1.27 (3H, t, *J* = 7.1, $CH_2C\underline{H}_3$)
2c	17.02	10.37 (t, *J* = 5.4)	7.69 (*J* = 8.0)	7.44 (*J* = 7.1)	7.14 (*J* = 7.4)	4.33 (*J* = 8.0)	3.41 (*J* = 7.8)	5.95 (1H, m, CH); 5.28 (1H, dd, *J* = 16.9, *J* = 1.7, $NCH_2CH{=}C\underline{H}$-*trans*); 5.17 (1H, dd, *J* = 11.0, *J* = 1.7, $NCH_2CH{=}C\underline{H}$-*cis*); 4.05 (2H, t, *J* = 5.5, $NC\underline{H}_2CH{=}CH_2$)
2d	17.25	10.28 (t, *J* = 5.2)	7.68 (*J* = 8.0)	7.43 (*J* = 7.1)	7.13 (*J* = 7.6)	4.32 (*J* = 8.3)	3.41 (*J* = 8.2)	3.37 (2H, q, *J* = 7.1, $NC\underline{H}_2CH_2CH_3$); 1.66 (2H, m, $NCH_2C\underline{H}_2CH_3$); 1.03 (3H, t, *J* = 7.1, CH_3)
2e	17.29	10.17 (d, *J* = 6.7)	7.70 (*J* = 8.3)	7.42 (*J* = 7.2)	7.13 (*J* = 7.5)	4.32 (*J* = 8.1)	3.41 (*J* = 8.1)	4.18 (1H, m, CH); 1.30 (6H, d, *J* = 7.0, $2CH_3$)
2f	17.26	10.25 (t, *J* = 4.8)	7.68 (*J* = 8.0)	7.43 (*J* = 7.2)	7.14 (*J* = 7.8)	4.32 (*J* = 8.5)	Cm. R	3.45-3.36 (4H, m, CH_2-6 + $NC\underline{H}_2$); 1.63 (2H, q, *J* = 7.4, $NCH_2C\underline{H}_2$); 1.46 (2H, m, $NCH_2CH_2C\underline{H}_2CH_3$); 0.99 (3H, t, *J* = 7.4, CH_3)
2g	17.25	10.35 (t, *J* = 5.2)	7.69 (*J* = 8.2)	7.43 (*J* = 6.8)	7.14 (*J* = 7.5)	4.33 (*J* = 8.2)	3.42 (*J* = 8.1)	3.25 (2H, t, *J* = 6.2, $NHC\underline{H}_2$); 1.93 (1H, m, CH); 1.02 (6H, d, *J* = 7.1, $2CH_3$)
2h	17.30	10.19 (d, *J* = 7.7)	7.68 (*J* = 8.1)	7.42 (*J* = 7.3)	7.13 (*J* = 7.7)	4.31 (*J* = 8.2)	3.41 (*J* = 8.2)	4.02 (1H, m, $NC\underline{H}$); 1.62 (2H, q, *J* = 7.3, $NCHC\underline{H}_2$); 1.26 (3H, d, *J* = 6.9, $NCHC\underline{H}_3$); 0.99 (3H, t, *J* = 7.3, $CH_2C\underline{H}_3$)
2i	17.25	10.33 (t, *J* = 5.2)	7.69 (*J* = 8.2)	7.39 (*J* = 7.1)	7.11 (*J* = 7.5)	4.32 (*J* = 8.3)	Cm. R	3.44-3.38 (4H, m, 6-CH_2 + $NC\underline{H}_2$); 1.65 (2H, q, *J* = 7.0, $NCH_2C\underline{H}_2$); 1.42 (4H, m, $(C\underline{H}_2)_2CH_3$); 0.96 (3H, t, *J* = 7.1, CH_3)
2j	17.26	10.23 (t, *J* = 5.3)	7.69 (*J* = 8.2)	7.43 (*J* = 7.4)	7.14 (*J* = 7.7)	4.31 (*J* = 8.0)	Cm. R	3.45-3.38 (4H, m, 6-CH_2+ $NHC\underline{H}_2$); 1.73 (1H, m, CH); 1.53 (2H, q, *J* = 7.4, $NCH_2C\underline{H}_2$); 0.98 (6H, d, *J* = 7.2, $2CH_3$)
2k	17.28	10.35 (t, *J* = 5.0)	7.65 (*J* = 8.1)	7.41 (*J* = 7.4)	7.11 (*J* = 7.7)	4.31 (*J* = 8.2)	3.39 (*J* = 8.0)	4.58 (1H, t, *J* = 4.5, OH); 3.61 (2H, q, *J* = 5.6, CH_2O); 3.47 (2H, q, *J* = 5.3, $NHC\underline{H}_2$)
2l	17.31	10.28 (t, *J* = 5.2)	7.67 (*J* = 8.0)	7.42 (*J* = 7.0)	7.13 (*J* = 7.5)	4.31 (*J* = 8.1)	3.40 (*J* = 7.9)	4.19 (1H, t, *J* = 5.2, OH); 3.55 (2H, q, *J* = 5.8, CH_2O); 3.48 (2H, q, *J* = 6.3, $NC\underline{H}_2$); 1.76 (2H, q, *J* = 6.2, $NCH_2C\underline{H}_2$)
2m	17.12	10.22 (d, *J* = 3.2)	7.69 (*J* = 8.0)	7.43 (*J* = 7.5)	7.14 (*J* = 7.8)	4.30 (*J* = 7.9)	3.41 (*J* = 8.0)	2.94 (1H, m, CH); 0.85 (2H, m, CH_2 cyclopropane); 0.66 (2H, m, CH_2 cyclopropane)
2n	17.29	10.29 (d, *J* = 7.1)	7.67 (*J* = 7.9)	7.41 (*J* = 7.1)	7.13 (*J* = 8.2)	4.30 (*J* = 7.9)	3.41 (*J* = 8.0)	4.34 (1H, m, CH); 2.04-1.40 (8H, m, $(CH_2)_4$ cyclopentane)
2o	17.32	10.34 (d, *J* = 7.3)	7.69 (*J* = 8.0)	7.42 (*J* = 7.2)	7.14 (*J* = 8.1)	4.31 (*J* = 8.0)	3.42 (*J* = 8.0)	3.91 (1H, m, CH); 1.93-1.20 (10H, m, $(CH_2)_5$ cyclohexane)
2p	17.31	10.34 (d, *J* = 7.7)	7.68 (*J* = 8.0)	7.43 (*J* = 6.9)	7.14 (*J* = 7.5)	4.32 (*J* = 8.3)	3.41 (*J* = 8.1)	4.11 (1H, m, CH); 1.95-1.43 (12H, m, $(CH_2)_6$ cycloheptane)
2q	17.42	10.26 (s)	7.68 (*J* = 8.1)	7.41 (*J* = 7.2)	7.13 (*J* = 7.7)	4.30 (*J* = 8.0)	3.41 (*J* = 8.0)	2.14 (9H, s, γ-H-bridgehead + β-H-bridging adamantane); 1.74 (6H, s, δ-H- bridging adamantane)

TABLE 3. Bond Lengths (l) in the Structure of Amide **2h**

Bond	*l*, Å	Bond	*l*, Å
$N_{(1)}$–$C_{(9)}$	1.367(2)	$N_{(1)}$–$C_{(1)}$	1.367(2)
$N_{(1)}$–$C_{(10)}$	1.461(2)	$N_{(2)}$–$C_{(12)}$	1.335(3)
$N_{(2)}$–$C_{(13A)}$	1.471(1)	$N_{(2)}$–$C_{(13B)}$	1.471(1)
$O_{(1)}$–$C_{(9)}$	1.242(2)	$O_{(2)}$–$C_{(7)}$	1.326(2)
$O_{(3)}$–$C_{(12)}$	1.262(2)	$C_{(1)}$–$C_{(6)}$	1.380(3)
$C_{(1)}$–$C_{(2)}$	1.389(3)	$C_{(2)}$–$C_{(3)}$	1.367(3)
$C_{(2)}$–$C_{(11)}$	1.510(3)	$C_{(3)}$–$C_{(4)}$	1.401(3)
$C_{(4)}$–$C_{(5)}$	1.367(3)	$C_{(5)}$–$C_{(6)}$	1.415(3)
$C_{(6)}$–$C_{(7)}$	1.426(3)	$C_{(7)}$–$C_{(8)}$	1.382(3)
$C_{(8)}$–$C_{(9)}$	1.460(3)	$C_{(8)}$–$C_{(12)}$	1.465(3)
$C_{(10)}$–$C_{(11)}$	1.546(3)	$C_{(13A)}$–$C_{(16A)}$	1.539(1)
$C_{(13A)}$–$C_{(14A)}$	1.540(1)	$C_{(14A)}$–$C_{(15A)}$	1.540(1)
$C_{(13B)}$–$C_{(16B)}$	1.540(1)	$C_{(13B)}$–$C_{(14B)}$	1.540(1)
$C_{(14B)}$–$C_{(15B)}$	1.540(1)		

TABLE 4. Valence Angles (ω) in the Structure of Amide **2h**

Angle	ω, deg	Angle	ω, deg
$C_{(9)}$–$N_{(1)}$–$C_{(1)}$	122.8(2)	$C_{(9)}$–$N_{(1)}$–$C_{(10)}$	125.9(2)
$C_{(1)}$–$N_{(1)}$–$C_{(10)}$	111.3(2)	$C_{(12)}$–$N_{(2)}$–$C_{(13A)}$	125.8(2)
$C_{(12)}$–$N_{(2)}$–$C_{(13B)}$	117.0(3)	$N_{(1)}$–$C_{(1)}$–$C_{(6)}$	123.7(2)
$N_{(1)}$–$C_{(1)}$–$C_{(2)}$	111.9(2)	$C_{(6)}$–$C_{(1)}$–$C_{(2)}$	124.3(2)
$C_{(3)}$–$C_{(2)}$–$C_{(1)}$	117.8(2)	$C_{(3)}$–$C_{(2)}$–$C_{(11)}$	134.2(2)
$C_{(1)}$–$C_{(2)}$–$C_{(11)}$	107.9(2)	$C_{(2)}$–$C_{(3)}$–$C_{(4)}$	119.4(2)
$C_{(5)}$–$C_{(4)}$–$C_{(3)}$	122.5(2)	$C_{(4)}$–$C_{(5)}$–$C_{(6)}$	119.0(2)
$C_{(1)}$–$C_{(6)}$–$C_{(5)}$	116.9(2)	$C_{(1)}$–$C_{(6)}$–$C_{(7)}$	116.0(2)
$C_{(5)}$–$C_{(6)}$–$C_{(7)}$	127.1(2)	$O_{(2)}$–$C_{(7)}$–$C_{(8)}$	122.1(2)
$O_{(2)}$–$C_{(7)}$–$C_{(6)}$	117.3(2)	$C_{(8)}$–$C_{(7)}$–$C_{(6)}$	120.7(2)
$C_{(7)}$–$C_{(8)}$–$C_{(9)}$	121.5(2)	$C_{(7)}$–$C_{(8)}$–$C_{(12)}$	118.0(2)
$C_{(9)}$–$C_{(8)}$–$C_{(12)}$	120.5(2)	$O_{(1)}$–$C_{(9)}$–$N_{(1)}$	119.3(2)
$O_{(1)}$–$C_{(9)}$–$C_{(8)}$	125.4(2)	$N_{(1)}$–$C_{(9)}$–$C_{(8)}$	115.3(2)
$N_{(1)}$–$C_{(10)}$–$C_{(11)}$	104.0(2)	$C_{(2)}$–$C_{(11)}$–$C_{(10)}$	104.7(2)
$O_{(3)}$–$C_{(12)}$–$N_{(2)}$	121.5(2)	$O_{(3)}$–$C_{(12)}$–$C_{(8)}$	119.6(2)
$N_{(2)}$–$C_{(12)}$–$C_{(8)}$	118.9(2)	$N_{(2)}$–$C_{(13A)}$–$C_{(16A)}$	117.9(4)
$N_{(2)}$–$C_{(13A)}$–$C_{(14A)}$	104.1(3)	$C_{(16A)}$–$C_{(13A)}$–$C_{(14A)}$	104.9(4)
$C_{(15A)}$–$C_{(14A)}$–$C_{(13A)}$	112.9(4)	$N_{(2)}$–$C_{(13B)}$–$C_{(16B)}$	129.9(5)
$N_{(2)}$–$C_{(13B)}$–$C_{(14B)}$	103.0(4)	$C_{(16B)}$–$C_{(13B)}$–$C_{(14B)}$	105.1(6)
$C_{(15B)}$–$C_{(14B)}$–$C_{(13B)}$	104.1(8)		

loading calculated as 25 ml/kg by gastric intubation. The investigated compounds were introduced intragastrically at a dose of 25 mg/kg (the effective dose for *furosemid*) after which the experimental animals were placed in a "etabolic cage". Diuresis was measured over 2 h taking the control as 100% (Table 1). A rather high diuretic activity was noted for the cyclopentylamide **2n**, and only a little inferior to that of *furosemid*. As we have shown previously [11, 12] the diuretic properties are more or less only characteristic of 4-hydroxy-2-oxo-1,2-dihydroquinoline-3-carboxylic acid arylalkylamides and the activity disappears completely when crossing to the alkylamides. Hence $C_{(8)}$/$N_{(1)}$ annelation of a 4-hydroxy-2-oxo-1,2-dihydroquinoline ring to a dihydropyrrole can be considered as a structural factor leading to the development of diuretic action. This fact undoubtedly merits attention and further study.

EXPERIMENTAL

^{1}H NMR spectra for the synthesized compounds were recorded on a Bruker WM-360 (360 MHz) spectrometer using DMSO-d_6 solvent and TMS internal standard. Monitoring of the course of the amidation of ester **1** was carried out by TLC on Silufol UV-254 plates in the system hexane-ether (1:2) and revealed using iodine vapor. Ethyl 1-hydroxy-3-oxo-5,6-dihydro-3H-pyrrolo[3,2,1-*ij*]quinoline-2-carboxylate **1** was prepared by the method in [13].

1-Hydroxy-3-oxo-5,6-dihydro-3H-pyrrolo[3,2,1-*ij*]quinoline-2-carboxylic Acid Methylamide (2a). A solution of the ethyl ester **1** (2.59 g, 0.01 mol) in ethanol (20 ml) was saturated with gaseous methylamine and left at room temperature for 3 h. The reaction mixture was diluted with cold water and acidified with dilute (1 : 1) HCl to pH 4.5-5.0. The precipitated amide **2a** was filtered off, washed with water, and dried.

Ethylamide 2b was synthesized by a similar method.

1-Hydroxy-3-oxo-5,6-dihydro-3H-pyrrolo[3,2,1-*ij*]quinoline-2-carboxylic Acid Allylamide (2c). Allylamine (0.83 ml, 0.011 mol) was added to a solution of ethyl ester **1** (2.59 g, 0.01 mol) in ethanol (15 ml) and refluxed using a reflux condenser for 2 h (in the case of other sterically hindered amines the reaction time was increased to 3-4 h). Work up of the reaction mixture and separation of the final material was carried out as reported in the previous method.

Alkylamides 2d-q were prepared similarly.

X-ray Structural Investigation. Crystals of the *sec*-butylamide **2h** are triclinic (ethanol). At 20ºC: $a = 7.198(1)$, $b = 8.658(1)$, $c = 12.591(1)$ Å, $\alpha = 71.88(1)$, $\beta = 82.293(1)$, $\gamma = 77.59(1)$º, $V = 726.4(1)$ Å^3, $M_r = 286.32$, $Z = 2$, space group $P\bar{1}$, $d_{calc} = 1.309$ g/cm^3, $\mu(MoK\alpha) = 0.091$ mm^{-1}, $F(000) = 304$. The parameters of the unit cell and intensities of 6179 reflections (2518 independent , $R_{int} = 0.022$) were measured on an Xcalibur-3 diffractometer (MoKα radiation, CCD detector, graphite monochromator, ω-scanning, $2\theta_{max} = 50$º).

The structure was solved by a direct method using the SHELXTL program package [14]. For refinement of the structure limits were set on the bond lengths in the randomized fragment of N–C_{sp3} 1.47(1) and C_{sp3}–C_{sp3} 1.54(1) Å. The position of the hydrogen atoms were revealed from electron density difference synthesis and for the randomized part of the molecule calculated geometrically and refined using the *riding* model with $U_{iso} = nU_{eq}$ for a non-hydrogen atom bound to the given hydrogen ($n = 1.5$ for a methyl group and $n = 1.2$ for the remaining hydrogen atoms). The structures were refined by F^2 full matrix least squares analysis in the anisotropic approximation for non-hydrogen atoms to $wR_2 = 0.0124$ for 2418 reflections ($R_1 = 0.048$ for 1315 reflections with $F>4\sigma(F)$, $S = 0.869$). The full crystallographic information has been placed in the Cambridge structural data bank (reference CCDC 604003). Interatomic distances and valence angles are given in Tables 3 and 4.

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