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Short Note

Crystal Structure of *N*-(2-Benzoyl-4,5-dimethoxyphenethyl)-2-phenylacetamide

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Abstract: The crystal structure of *N*-(2-benzoyl-4,5-dimethoxyphenethyl)-2-phenylacetamide indicates that the compound crystallizes in the monoclinic *C*2/*c* space group with eight molecules in the unit cell. The heteroatoms from the amide group form a chain of intermolecular N-H ⋯ O hydrogen bonds propagating along the b axis. The carbonyl group from the benzoyl substituent participates in short contacts with two H-atoms from the ethyl or phenyl groups.

Keywords: crystal structure; phenylacetamide; ketoamide

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1. Introduction

The title compound was synthesized as a precursor for the synthesis of a series of differently substituted 1,2,3,4-tetrahydroisoquinolines and its molecular structure (Figure 1) was described on the basis of spectroscopic data (IR, ^{1}H and ^{13}C NMR) [1]. Besides their use as synthetic scaffolds, 2-phenylacetamides are also known for their application in medicinal chemistry as they possess a variety of biological activities depending on the structural features of the substituents. Their anticonvulsant [2], antidepressant [3] and antiproliferative [4] activities are only a few to mention. Herein, we report the crystal structure of *N*-(2-benzoyl-4,5-dimethoxyphenethyl)-2-phenylacetamide obtained by single-crystal X-ray diffraction analysis. The presence of suitable coordination groups in the studied ketoamide have provoked systemic study on its coordination properties and some data have recently been published [5]. The data showed that complexation with metal ions is strongly ruled by the coordination ability of the used metal ion. This could be explained with the conformational flexibility of the title compound and its intrinsic ability to form various types of intermolecular hydrogen bonding. In this short note, we provide data on these structural features as observed in the crystal packing.

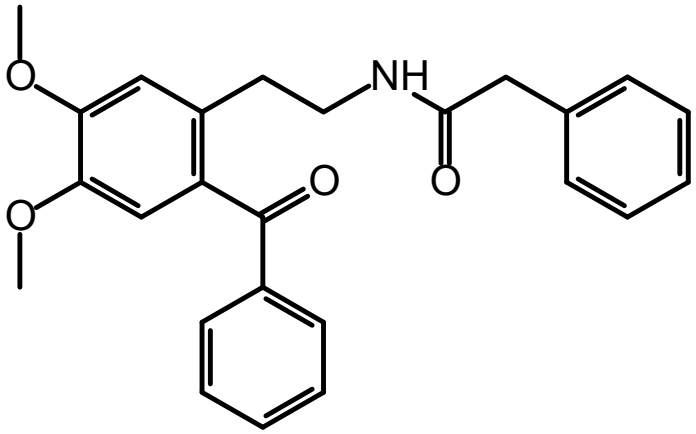

Figure 1. Molecular structure of *N*-(2-benzoyl-4,5-dimethoxyphenethyl)-2-phenylacetamide.

2. Results

The studied ketoamide compound crystallizes in the monoclinic $C2/c$ space group. The structure of the asymmetric unit is depicted in Figure 2, along with the atom numbering. All three aromatic rings in the molecule are almost orthogonal to each other. The unit cell contains eight molecules and is depicted in Figure 3, where the short contacts between the C-H and C-O groups from adjacent molecules are highlighted. All oxygen atoms participate in the formation of short contacts, whereas the C=O and N-H from the amide group participate in the formation of an intermolecular hydrogen-bonding chain. The propagation of this chain is shown in Figure 4, and the structural features of all hydrogen bonds are summarized in Table 1.

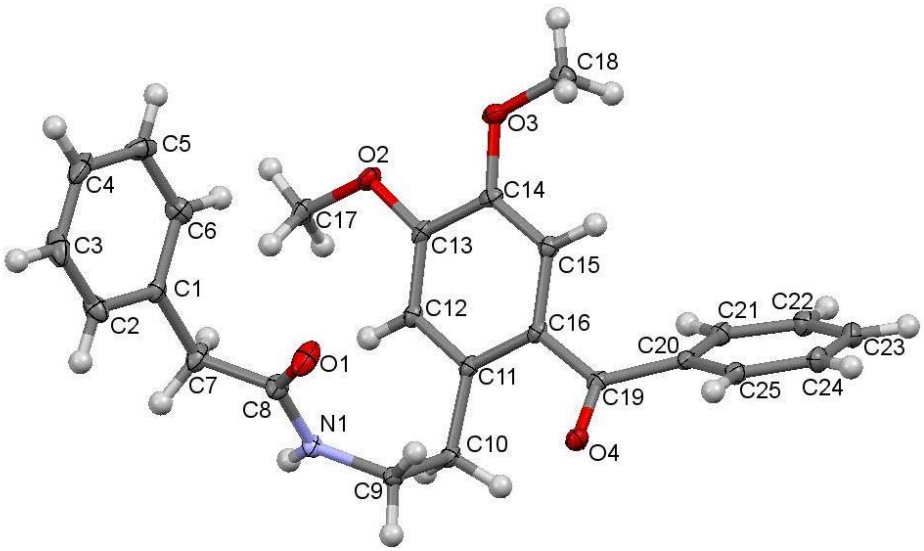

Figure 2. Crystal structure of *N*-(2-benzoyl-4,5-dimethoxyphenethyl)-2-phenylacetamide with atoms numbering.

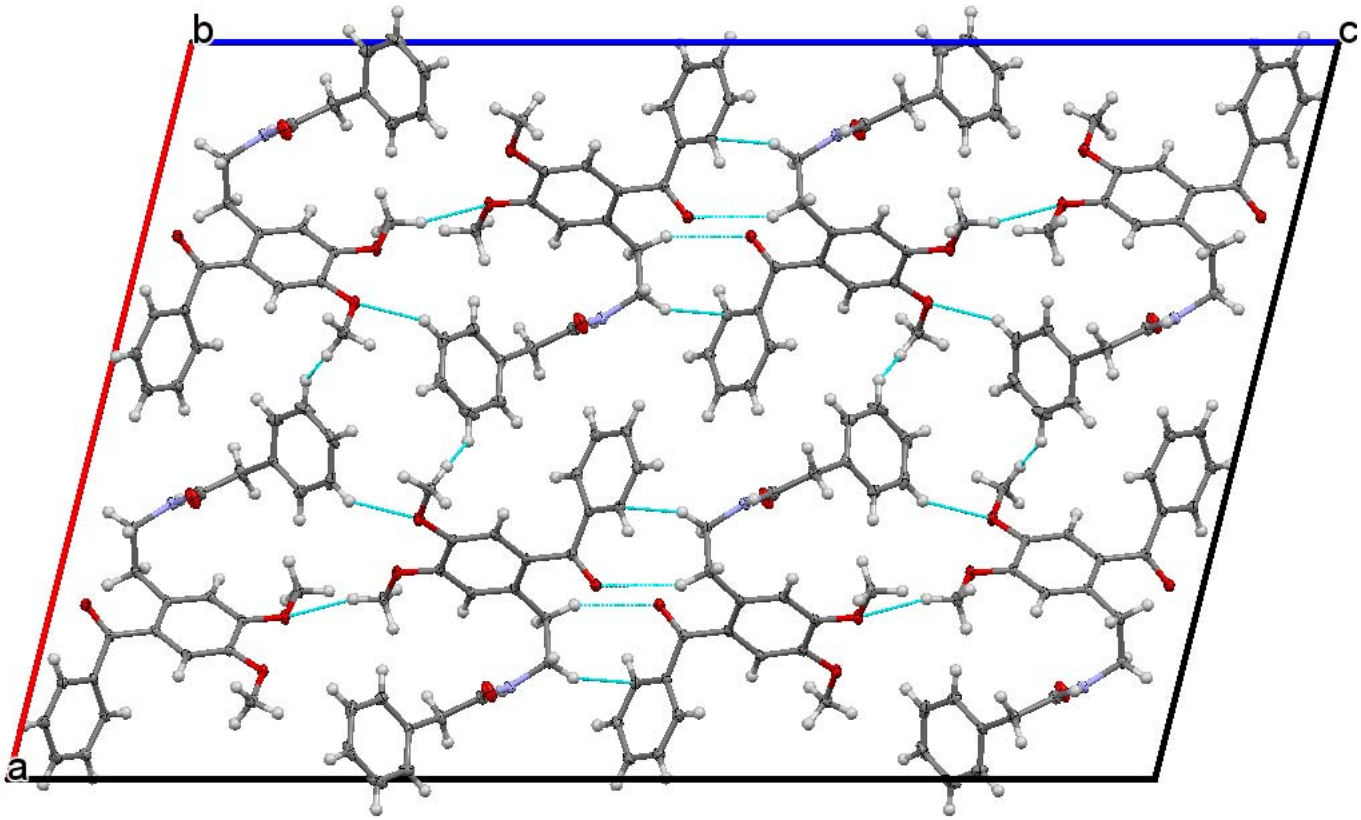

Figure 3. Unit cell view along the b axis showing the short contacts of C-H . . . O type.

Table 1. Hydrogen-bond geometry (distances in Å and angles in °) for *N*-(2-benzoyl-4,5-dimethoxyphenethyl)-2-phenylacetamide.

D—H···A	D—H	H···A	D···A	D—H···A
N1—H1···O1 i	0.844 (19)	2.055 (19)	2.8894 (19)	169.8 (16)
C10—H10A···O4	0.97	2.39	2.8885 (18)	111
C17—H17A···O2 ii	0.96	2.58	3.438 (2)	149
C17—H17C···O3 i	0.96	2.64	3.444 (2)	142

Symmetry codes: (i) x, y + 1, z; (ii) -x + 1/2, y + 1/2, -z + 1/2.

The title compound has previously been studied for its complexation ability with metal ions (Pd(II) and Zn(II)) and detailed spectroscopic data have been provided [5]. The crystal structure described herein corroborates with the findings from IR, Raman and NMR spectroscopies. The earlier reported IR stretching vibration for the carbonyl groups with frequencies lower than 1700 cm^{-1} (namely 1662 cm^{-1} for the C=O from the keto group and 1652 cm^{-1} for the C=O from the amide group [5]) may suggest that these groups are engaged in moderate intermolecular hydrogen bonding in the solid state, as evidenced by the crystal structure described here.

In summary, the crystal structure of the studied ketoamide reveals the participation of all oxygen atoms in the formation of either intermolecular hydrogen bonding of C=O . . . H-N type or short contacts with the C-H groups. The latter are CH—π interactions and are quite common in systems featuring aromatic rings. Positively charged hydrogen atoms willingly interact with the electron densities above and below the planes of aromatic rings and are part of Van der Waals interactions.

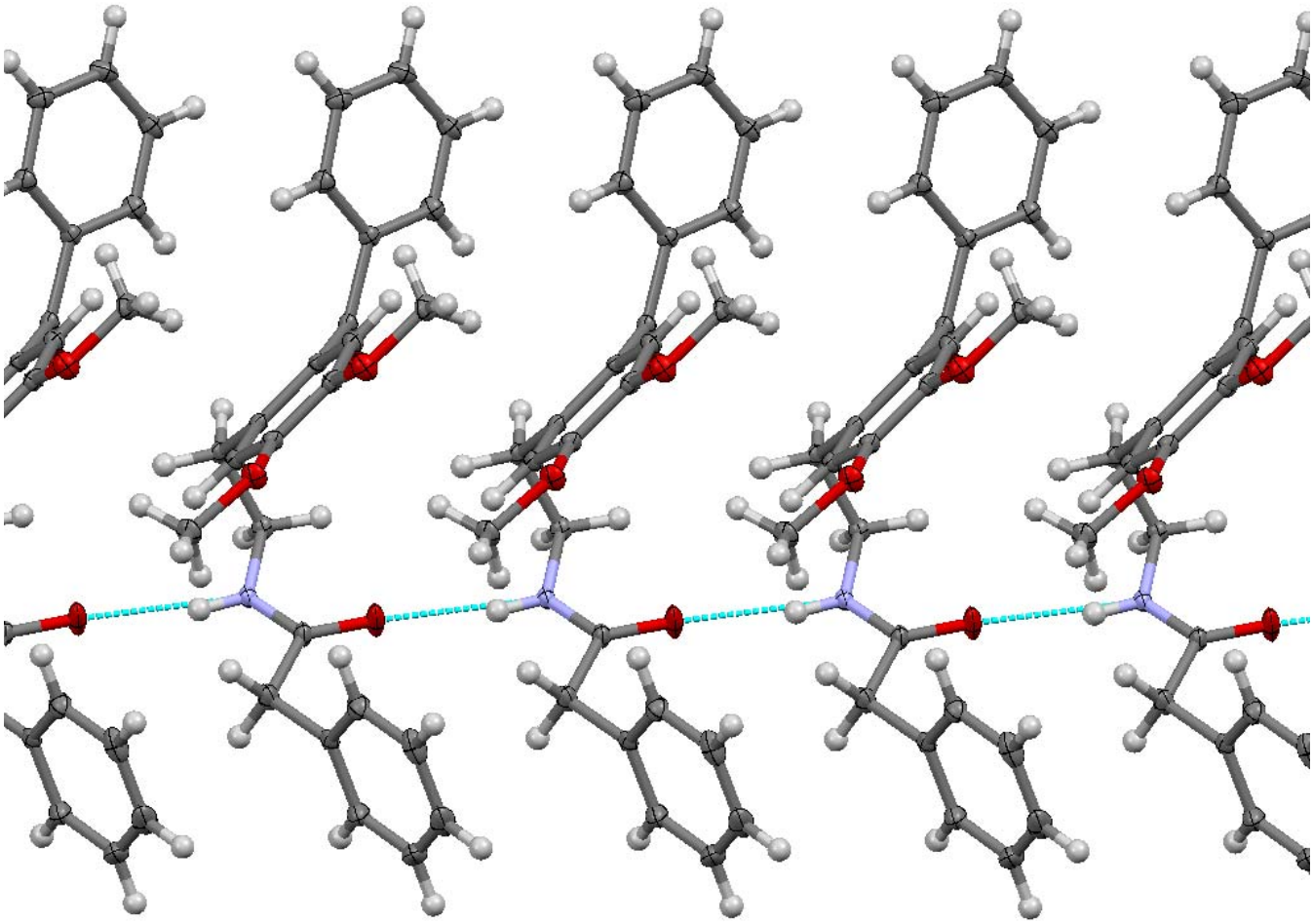

Figure 4. Chain of C=O ... H-N hydrogen bonding for *N*-(2-benzoyl-4,5-dimethoxyphenethyl)-2-phenylacetamide.

3. Experimental Section

Good quality single crystals from the title compound were obtained from DMSO-d_6 solution in an NMR tube after 1 month of slow evaporation. Yellow prisms with 0.54 × 0.26 × 0.11 mm were analyzed on a 2-circle diffractometer STOE IPDS 2T using GeniX Mo, 0.05 × 0.05 mm^2 microfocus as a source for monochromated MoKα radiation (λ = 0.71073 Å) at 120(2) K. Crystal data, data collection and structure refinement details are summarized in Table 2.

The diffraction data were corrected for absorption effects by the Gaussian integration method implemented in the STOE X-Red32 software. Unit cell parameters were calculated and refined from the full data set. The structures were solved by a full-matrix least squares procedure based on F^2 using the SHELX–2014 program package [6], implemented in the Olex [7] and Wingx [8] suites of programs. All non-hydrogen atoms were refined anisotropically, and the positions of the hydrogen atoms were either calculated using a riding model in isotropic approximation or deduced from the electron density map (N-H1). The crystal data have been deposited at the Cambridge Crystallographic Data Centre as CCDC 2157168. (Supplementary Materials). The data can be obtained free of charge from the Cambridge Crystallographic Data Centre via http://www.ccdc.cam.ac.uk/getstructures. Complete structural parameters for the title compound are listed in Table S1 in the Supplementary Materials along with the ^{1}H and ^{13}C NMR spectra.

Table 2. Experimental details.

Crystal Data	
Chemical formula	$C_{25}H_{25}NO_4$
M_r	403.46
Crystal system, space group	Monoclinic, *C*2/*c*
Temperature (K)	120
a, *b*, *c* (Å)	23.724 (9), 4.9750 (15), 35.816 (15)
b (°)	103.99 (3)
V (Å^3)	4102 (3)
Z	8
Radiation type	Mo *Ka*
m (mm^{-1})	0.09
Crystal size (mm)	0.54 × 0.26 × 0.11
Data collection	
Diffractometer	STOE *IPDS* 2T
Absorption correction	Integration ; STOE *X-RED32*, absorption correction by Gaussian integration
T_{min}, T_{max}	0.970, 0.993
No. of measured, independent and observed [$I > 2s(I)$] reflections	13109, 4005, 3221
R_{int}	0.042
(sin q/l)$_{max}$ (Å^{-1})	0.617
Refinement	
$R[F^2 > 2s(F^2)]$, $wR(F^2)$, *S*	0.041, 0.113, 1.05
No. of reflections	4005
No. of parameters	276
H-atom treatment	H atoms treated by a mixture of independent and constrained refinement
Dρ$_{max}$, Dρ$_{min}$ (e Å^{-3})	0.26, −0.25

Supplementary Materials: The following supporting information can be downloaded online; Table S1: Geometric parameters (bond lengths in Å, and angles in °) for *N*-(2-benzoyl-4,5-dimethoxyphenethyl)-2-phenylacetamide, along with the cif and check-cif files. ^{1}H and ^{13}C NMR spectra are given in Figures S1 and S2, respectively.

Author Contributions: P.M. and S.N. prepared the compound; A.D. collected the X-ray data and solved the structure; P.M. and S.N. designed the study; A.A. analyzed the data and wrote the paper. All authors have read and agreed to the published version of the manuscript.

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Informed Consent Statement: Not applicable.

Data Availability Statement: The X-ray data are available at CCDC under ref. code CCDC 2157168.

Conflicts of Interest: The authors declare no conflict of interest.

Sample Availability: Samples of the compound are not available.

References

1. Ivanov, I.; Nikolova, S.; Aladjov, D.; Stefanova, I.; Zagorchev, P. Synthesis and Contractile Activity of Substituted 1,2,3,4-Tetrahydroisoquinolines. *Molecules* **2011**, *16*, 7019–7042. [CrossRef] [PubMed]
2. Shindikar, A.V.; Viswanathan, C.L. Substituted 2-[2-(pyridin-3-yl) phenyl] acetamides and ureas: Design, synthesis, and anticonvulsant screening in mice. *Med. Chem. Res.* **2012**, *21*, 1929–1934. [CrossRef]
3. Shelke, S.M.; Bhosale, S.H. Synthesis, antidepressant evaluation and QSAR studies of novel 2-(5H-[1, 2, 4] triazino [5, 6-b] indol-3-ylthio)-N-(substituted phenyl) acetamides. *Bioorg. Med. Chem. Lett.* **2010**, *20*, 4661–4664. [CrossRef] [PubMed]

4. Chen, I.L.; Chen, J.J.; Lin, Y.C.; Peng, C.T.; Juang, S.H.; Wang, T.C. Synthesis and antiproliferative activities of N-(naphthalen-2-yl)acetamide and N-(substituted phenyl)acetamide bearing quinolin-2(1H)- one and 3,4-dihydroquinolin-2(1H)-one derivatives. *Eur. J. Med. Chem.* **2013**, *59*, 227–234. [CrossRef] [PubMed]
5. Marinova, P.E.; Tsoneva, S.H.; Nikolova, S.A.; Ivanov, I.I. Novel complexes of N-substituted-4,5-dimethoxy-phenylethyl-2-arylketoamides with metal ions. *Bulg. Chem. Commun.* **2019**, *51*, 8–11.
6. Sheldrick, G.M. Crystal Structure Refinement with SHELXL. *Acta Crystallogr. Sect. C* **2015**, *71*, 3–8. [CrossRef] [PubMed]
7. Dolomanov, O.V.; Bourhis, L.J.; Gildea, R.J.; Howard, J.A.K.; Puschmann, H. OLEX2: A complete structure solution, refinement and analysis program. *J. Appl. Crystallogr.* **2009**, *42*, 339–341. [CrossRef]
8. Farrugia, L.J. WinGX and ORTEP for Windows: An update. *J. Appl. Crystallogr.* **2012**, *45*, 849–854. [CrossRef]