

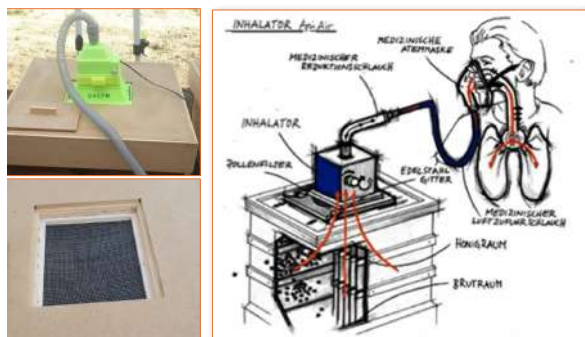
Chemical Profiling of Beehive Air (Apiair) and its Biochemical Effects on an Asthmatic Rat Model

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Introduction

The use of products such as honey, propolis, royal jelly, pollen, bee bread, bee venom and beeswax for health is called apitherapy, which means treatment with bee products. It is defined in the Ministry of Health's Regulation on Traditional and Complementary Medicine practices as "the use of bees and bee products as a preventive measure and as a support in the treatment of certain diseases".



Aim of the Study

The **biochemical effects** of Apiair and its combination with chestnut honey on rats, particularly in an asthma model.
The **chemical composition** of beehive air using **GC-MS analysis**, to characterize its active volatile components.
The variability of hive air components among different colonies, to highlight the need for **standardization** in Apiair applications

Materials and Methods

Chemical Composition Analysis: GC-MS used to identify volatile components in hive air. Each colony analyzed
Subjects: 64 female Wistar Albino rats (250–300 g)



Experimental Groups (n = 8 per group):
Control
Beehive air (Apiair)
Chestnut honey (200 mg/kg/day)
Chestnut honey + Beehive air

Experimental Groups (n = 8 per group):
Asthmatic rats
Asthmatic + Beehive air
Asthmatic + Chestnut honey
Asthmatic + Beehive air + Chestnut honey

Sample Collection and Biochemical Analysis:
Oxidative stress biomarkers: MDA, SOD, CAT, GPx, GSH
Methods: Standard spectrophotometric protocols



Oxidative Stress Findings:

Group 2 (Apiair) and Group 3 (Honey) showed moderate improvements in oxidative stress parameters compared to the healthy control (Group 1).

Group 4 (Apiair + Honey) had better antioxidant outcomes than Apiair or honey alone.

Asthmatic control group (Group 5) showed the **highest MDA levels** and reduced antioxidant enzyme activity.

Group 6 (Asthma + Apiair) and Group 7 (Asthma + Apiair + Honey) exhibit significantly **lower MDA** and **improved antioxidant defense** (↑ SOD, CAT, GPx, GSH).

Group 7 demonstrated the most pronounced protective effect.

22+ 24 volatile compounds were identified in hive air, including:

Aldehydes (nonanal, decanal)
Terpenes (limonene, α-pinene)
Acids (butyric, caprylic acids)
Phenolics (eugenol, methyl salicylate)

Composition **varied significantly** between colonies, even in close proximity.

Table 1. List of volatile components

Chemical Compound Name	Retention Time (minutes)	Chemical Compound Name	Retention Time (minutes)
1 1,4-Pentadiene	5.752	1 1,3-Dioxolane, 2-methyl-	9.192
2 1,3-Dioxolane, 2-methyl-	9.195	2 Heptane	11.207
3 1-Pentene, 2-methyl-	10.133	3 Furfural	14.717
4 Hexane, 2,4-dimethyl-	14.578	4 2-Heptanone, 3-methyl-	15.007
5 Cyclopentanone, 2-methyl-	17.004	5 Pentanoic acid	16.197
6 α-Pinene	19.236	6 Cyclopentanone, 2-methyl-	17.007
7 Benzene, 1-ethyl-2-methyl-	19.667	7 Heptanal	17.257
8 Camphene	19.744	8 Decane	17.867
9 Benzene, 1-ethyl-3-methyl-	20.271	9 2-Furancarboxaldehyde, 5-methyl-	18.997
10 Octanal	20.461	10 Camphene	19.747
11 β-Pinene	20.558	11 Trimethylsilyl methyl sulfide	20.267
12 δ-Limonene	21.902	12 β-Pinene	20.567
13 Undecane, 3,7-dimethyl-	22.703	13 Bicyclo[3.1.1]hept-2-ene-2-methanol, 6,6-dimethyl-	21.457
14 Nonanal	23.374	14 Benzene, 1-ethyl-4-ethyl-	23.227
15 Decane, 4-methyl-	23.711	15 Octanoic acid	24.727
16 Undecane, 5,7-dimethyl-	23.878	16 Benzaldehyde, 3-ethyl-	25.107
17 Cyclohexanol	25.139	17 Octane, 1-chloro-	25.227
18 Pinocarvone	25.383	18 Pinocarvone	25.237
19 Decanal	26.027	19 Benzaldehyde, 2,5-dimethyl-	25.547
20 Dodecane	26.227	20 Bicyclo[3.1.1]hept-3-en-2-one, 4,6,6-trimethyl-	26.477
21 Bicyclo[3.1.1]hept-3-en-2-one, 4,6,6-trimethyl-, (1S)-, (2-Pinen-4-one)	26.477	21 Citral	27.257
22 Benzothiazole	26.884	22 Benzaldehyde, 4-(1-methyl-ethyl)-	27.257
23 Hexadecane	28.599	22 (cinnamaldehyde)	28.857
24 5,9-Undecadien-2-one, 6,10-dimethyl-, (E)-	31.566	23 1,3-Dioxolane, 2-methyl-	9.192
		24 Heptane	11.207

Table 2. Serum Antioxidant Levels in Control and Treatment Groups (Mean±SE).

Groups Parameters	1. Control (n=7)	2. Asthmatic (15 times) (n=8)	3. Apiair (30 min.) 2 times (n=8)	4. Honey (n=8)	5. Apiair + Honey (n=7)
MDA (nmol/mL)	0.63±0.06a	0.58±0.04	0.50±0.04	0.51±0.06	0.43±0.07
CAT (ng/mL)	9.10±1.35	8.48±0.80	9.94±0.45	9.97±1.22	10.95±0.88
SOD (U/mL)	16.85±1.17 ^a	16.91±0.95 ^a	14.41±1.50 ^a	20.01±2.04 ^a	21.24±1.11 ^a
GSH (mg/dL)	402.14±10.50	409.17±15.13	387.50±11.66	428.33±21.35	413.33±12.29
GPx (ng/mL)	21.41±2.86	21.87±1.52	23.23±2.20	24.55±1.71	24.73±2.74

Conclusion

Apiair, especially in combination with chestnut honey, reduced oxidative stress markers in both healthy and asthmatic rats. The findings suggest its potential as a complementary therapy for respiratory conditions. However, variability in hive air composition underscores the need for standardization before clinical use.

Discussion

Hive air contains a complex mix of volatiles from honey, propolis, wax, and bee bread. Composition varies between colonies, even in the same apiary (Bengish, 2016).

In this study, 30 min/day Apiair exposure showed positive effects, especially when combined with honey.

For therapeutic use, application frequency and duration should match disease severity (Guardia, 2020).

Colony health matters: Air from unhealthy hives may cause harm (Balas, 2000). Standardization and safety control are essential before clinical use.

References & Acknowledgments

This study was supported by Düzce University Beekeeping Research, Development and Application Center (DAGEM). The authors would like to thank the GC-MS analysis team and laboratory staff for their valuable contributions.
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The use of bee products such as honey, propolis, pollen, bee bread, royal jelly, bee venom, and beeswax for health purposes is called apitherapy, which means treatment with bee products. One of the apitherapy methods is Apiair (beehive air) therapy, which involves the inhalation of volatile components naturally released from bee products such as honey, propolis, beeswax, and pollen inside the hive. These components mix with the air inside the hive and are inhaled in a controlled manner through a specially filtered fan mechanism. Apiair therapy is used as a supportive treatment for respiratory diseases such as asthma, bronchitis, emphysema, and COPD. This method is commonly practiced in Germany, Austria, Slovenia, Ukraine, and Hungary. However, there is currently no scientific study validating its effectiveness. With the growing interest in traditional and complementary medicine, Apiair therapy is being applied in an uncontrolled and unregulated manner. Therefore, this study aimed to investigate the biochemical effects of Apiair (beehive air) therapy on rats with asthma model. Additionally, the composition of hive air in all bee colonies used for Apiair application was analyzed using the GC/MS method. In this study, 32 female Wistar Albino rats were used and homogeneously divided into four groups: Control group, Apiair group, Honey group, Apiair + Honey group. At the end of the study, when the beehive air groups were compared with the control group, it was observed that MDA and SOD values were lower in the Apiair + Honey group and IgE and CRP values were lower in the Apiair group which was exposed to hive air for 30 minutes. Additionally, the hive air content analysis showed differences in volatile components even among colonies that were placed close to each other. A total of over 42 different volatile compounds were identified, with varying profiles between hives. These findings suggest that Apiair therapy has positive effects on rats. However, the differences in hive air composition between colonies indicate that standardization is necessary to ensure the effectiveness and consistency of this therapy.