

ORIGINAL RESEARCH

The Relationship Between the Use of Apitherapy Products and the Frequency of Constipation in Adults

Ayfer Beyaz Coskun^{1*} , Semra Turkoglu¹ , Ezgi Boler² , Zehra Betul Tomar³ ,
Esra Guven⁴ 

¹ Department of Nutrition and Dietetics, Firat University, Elazig, Türkiye

² Department of Nutrition and Dietetics, B fit wellness center, Elazig, Türkiye

³ Department of Nutrition and Dietetics, Diyarbakir Hani District State Hospital, Diyarbakir, Türkiye

⁴ Department of Nutrition and Dietetics, Home Office, Elazig, Türkiye

* Corresponding Author: Ayfer Beyaz Coskun, e-mail: abeyaz@firat.edu.tr

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Abstract

Objective: This study aims to reveal the effectiveness of apitherapy products on constipation, as well as other possible risk factors, in individuals with functional constipation.

Material-Method: This cross-sectional study was conducted with 652 adults (460 men and 192 women) between the ages of 18-65 in Turkey. Constipation was defined as defecation frequency of less than 3 times a week. Dietary fluid and fiber intake was assessed by the 62-item food consumption frequency (FFQ). The use of bee products was questioned in terms of quantity and frequency. Physical activity status was questioned with a 3-question short form.

Results: It was determined that 17.8% of the cohort (19.1% males, 14.6% females) had constipation. The percentage of constipation was higher in underweight individuals (28.5%) compared to other Body Mass Index (BMI) groups. Individuals with chronic diseases have a higher percentage of constipation (22.4%) than those without the disease. A significant relationship was found between constipation and fiber intake ($p = 0.001$). Honey ($p=0.013$) and royal jelly ($p=0.030$) intake was significantly higher in individuals without constipation than in individuals with constipation.

Conclusion: The rate of functional constipation is high in Turkish adults. Fiber intake, presence of chronic disease and BMI affect constipation. Constipation is lower in those who consume honey and royal jelly from bee products. Interventional studies are needed on the use of bee products to reduce the symptoms and frequency of constipation.

Keywords: Apitherapy, Constipation, Fiber, Physical Activity

INTRODUCTION

Constipation is one of the most common gastrointestinal problems. Constipation is generally defined as infrequent, hard, painful defecation and incomplete emptying of the rectum. The term functional constipation describes constipation that is not based on any organic etiology and accounts for 90% of constipation cases in early ages.¹⁻⁴ It is known that conditions such as abdominal discomfort, abdominal pain, and fecal incontinence due to chronic constipation cause emotional, behavioral and social problems in individuals and negatively affect the quality of life. This situation has led to new searches for treatment options. Today, emphasis is placed on dietary fiber, probiotics, family and individual education, and regulation of toilet habits in the treatment of constipation.^{1,5,6}

The complex communities of microorganisms that

colonize the gastrointestinal tract play an important role in human health. Intestinal microbiota plays an important role in many metabolic, physiological and immunological events in humans, especially nutrition. Due to all these features, the intestinal system microbiota has become the focus of attention and has been the subject of many studies in recent years. As these studies increase, it is important to identify nutritional treatments that have positive effects on the intestinal microbiota and reveal their positive effects.^{7,8} Some herbal formulas for the treatment of constipation are supported by limited evidence, but the lack of a safe dose determination is a potential concern.

Apitherapy is the science of using honeybee products to maintain health and help the individual regain health in case of illness. Pollen, a bee product, is the male reproductive unit formed in the

antennae of higher flowering plants. It is transferred to the stigma of a flower by wind, water, and various animals. One of the animals that provide this transfer is bees.⁹ Bees add nectar and honeybee enzymes secreted from salivary glands (e.g., catalase, amylase) to flower pollen to create pollen loads known as bee pollen.¹⁰ Metabolites found in bee pollen show antioxidant,¹¹ anti-inflammatories,¹² antibacterial¹³ and liver protective¹⁴ properties. Bee bread is formed by the adding digestive enzymes and honey and the fermentation of lactic acid during the storage of pollen in the honeycomb.¹⁵ Bee bread has antimicrobial and antioxidant properties.¹⁶ Royal jelly is a secretion produced by the hypopharyngeal and mandibular salivary glands of young worker bees (bees aged 5-14 days), with a white-yellowish, gelatinous-viscous sour taste and a slight phenol odor.¹⁷ It is recommended for the treatment of osteoporosis, wounds, immune disorders and as a preventive measure against cancer.⁹ Bee venom is a transparent liquid used in the defense of the hive. Its composition includes biologically active molecules such as melittin, apamin, phospholipase 2, histamine, dopamine, norepinephrine and others.¹⁸ Honey is a natural with many medicinal effects, including antibacterial, liver-protective, antihypertensive and antioxidant.¹⁹ Propolis is a resinous substance collected from the buds of plants and created by bees by mixing them with enzymes, pollen and wax from their secretions. It is stated to be effective in antioxidant activity, antiviral effects, radiation protection and wound treatment.⁹ Natural products are promising for discovering new pharmaceuticals in gut health. However, few studies have investigated the effects of apitherapy products on constipation. Therefore, this study aimed to contribute to dietary treatment approaches in constipation by examining the effects of apitherapy on constipation.

MATERIALS AND METHODS

Study populations

This cross-sectional study was conducted using a random sampling method with 652 adult individuals between the ages of 18-65 who applied to a health center in Turkey between January 2023 and December 2023. Before starting the study, volunteer participants were informed about the study and had to sign a "Voluntary Consent Form" in compliance with the Declaration of Helsinki protocols (World Medical Association). Firat University Non-Interventional Research Ethics Committee reviewed

and approved the study (2022/03-45). Study data was generated through a survey using face-to-face interview method. Individuals under 19 years of age and over 55 years of age, those with chronic health problems, individuals with disabilities, participants diagnosed with irritable bowel syndrome, those using products that affect bowel movements (laxatives, antidepressants, calcium channel blockers, opioids, pre- and probiotics and magnesium tablets), and pregnant/breastfeeding women were excluded from the study.

Assessment of constipation status

Constipation status was determined with a single question. Constipation was considered if the frequency of defecation was less than 3 times a week.²⁰

Dietary fiber, fluid, water and bee products intake

Semi-quantitative food frequency questionnaire (FFQ) has been validated for assessment of dietary intake in Turkish adults.²¹ Water (mL/d), fluid (mL/d), and dietary fiber (g/d) intake were assessed with a 62-item FFQ. FFQ modified to assess constipation-related habits.^{22,23} FFQ was also modified in line with the most commonly used foods in Turkey. Additionally, the use of bee products has been questioned.

Participants were asked how much and how often they consumed certain food groups (bread, whole-grain foods, pasta/rice, fruit, vegetables, potatoes, legumes, bee products, coffee, tea, kefir (fermented milk), ayran (yogurt-water), milk, alcoholic beverages and non-carbonated beverage) in the last month. The "Food and Nutrition Photo Catalog" was used so that the participants could accurately remember the quantities and measurements of the drinks and foods they consumed. Food consumption status and constipation status in the last month were evaluated together. Fiber intake was evaluated with the US Department of Agriculture (USDA) (National Nutrient Database for Standard Reference, Release 25 Software v.1.2.2) database. Water, fluid and fiber intake was evaluated in quartile ranges.

Anthropometric measurements

Body weights (kg) were measured with a Tanita BC 545N portable body analyzer. Leicester brand stadiometer was used for height measurement. While the head was in the Frankford plane and the individual was in an upright position, the measurement was recorded with a sensitivity of 0.1 cm by taking deep breaths. Students' Body Mass Index (BMI) was calculated by dividing their body weight by the square of their height (body

weight/height (kg/m^2)).²⁴ BMI values are classified as normal weight ($<25 \text{ kg}/\text{m}^2$), overweight ($25\text{--}29.9 \text{ kg}/\text{m}^2$), and obese ($\geq 30 \text{ kg}/\text{m}^2$) according to the World Health Organization (WHO) classifications.²⁵

Physical activity

To evaluate the physical activity status of individuals, the 3-question short form used by Marshall et al. (2005) was used. The first question asks about regular physical activity status. In the second question, "3 or more activities a week" is 4 points, "1-2 times a week" is 2 points, "never" is 0 points; In the third question, "5 or more times a week" is evaluated as 4 points, "3-4 times a week" is evaluated as 2 points, "1-2 times a week" is evaluated as 1 point, and "never" is evaluated as 0 points. If the score obtained by adding the second and third questions is ≥ 4 , it indicates that sufficient physical activity is performed.²⁶

Statistical analysis

Evaluation of the data was done with Statistical

Package for the Social Sciences 25.0, SPSS 25.0. Fisher exact tests or Chi-square tests determined constipation status in men and women according to BMI, age, education level, chronic disease status, smoking consumption and physical activity status. Data with normal distribution are shown as mean \pm standard deviation ($\bar{X}\pm\text{SD}$) value. When using descriptive data, number and percentage (%) distribution was used. Statistically significant values are expressed as $p < 0.05$.

RESULTS

This study was conducted with a total of 652 participants, 460 (70.6%) men and 192 (29.4%) women (Table 1). The average age of the participants was 25.8 ± 9.53 years. Of the total cohort, 17.8% were diagnosed with constipation (19.1% of males, 14.6% of females). No statistically significant difference was found between constipation status and gender ($p > 0.05$).

Table 1. Comparison of constipation prevalence by gender

Stool frequency (per week)	Male (n = 460)		Female (n = 192)		Total (n = 652)		p value
	n	%	N	%	n	%	
Constipated (<3)	88	19.1	28	14.6	116	17.8	0.166
Non-constipated (≥ 3)	192	80.9	164	85.4	536	82.2	

p was calculated by chi-square test. * $p < 0.05$

The characteristics of the participants according to constipation status are shown in Table 2. A statistically significant relationship was found between constipation and age, BMI, education level and presence of chronic disease ($p < 0.05$). However, no significant relationship was found between constipation and smoking and physical activity status ($p > 0.05$). The percentage of constipation in the 18-29 age range (20.0%) was

found to be higher than other age groups ($p < 0.05$). The constipation percentage of participants with low BMI (28.5%) was higher than the constipation percentage of normal (17.8%), overweight (12.1%) and obese (12.5%) participants (Table 2). The constipation percentage of high school graduates (30.6%) was found to be higher than that of university graduates (16.3%) and master's degree graduates (19.2%) (Table 2).

Table 2. The characteristics of the participants according to their constipation status.

		Constipated (n = 116)	Non-constipated (n = 536)	Prevalence of constipation (%)	p value
Age (years)	18-29	98 (84.5%)	392 (73.1%)	20.0	0.022
	30-39	6 (5.2%)	86 (16.0%)	6.5	
	40-49	8 (6.9%)	38 (7.1%)	17.3	
	50-59	4 (3.4%)	20 (3.7%)	16.6	
	60-69	2 (1.7%)	10 (1.9%)	12.5	
BMI (kg/m^2)	Underweight	24 (20.7%)	60 (11.2%)	28.5	0.017
	Normal	72 (62.1%)	332 (61.9%)	17.8	
	Overweight	14 (12.1%)	102 (19.0%)	12.1	
	Obese	6 (5.2%)	42 (7.8%)	12.5	
Educational Level	Primary School	-	10 (1.9%)	-	0.022
	Secondary School	-	2 (0.4%)	-	
	High School	22 (19.0%)	50 (9.3%)	30.6	
	University	84 (72.4%)	432 (80.6%)	16.3	
	Master's degree	10 (8.6%)	42 (7.8%)	19.2	
Chronic Disease	Yes	22 (19.0%)	76 (14.2%)	22.4	0.013
	No	94 (81.0%)	460 (85.8%)	17.0	
Smoking	Yes	20 (17.2%)	102 (19%)	16.4	0.809
	No/Quit	96 (82.8%)	434 (81%)	18.1	
Physical Activity	Inactive	90 (77.6%)	394 (73.5%)	18.6	0.362
	Active	26 (22.4%)	142 (26.5%)	15.5	

p was calculated by chi-square test. BMI: Body mass index. Significant values are shown in bold ($p < 0.05$)

The participants' use of bee products is shown in Table 3. The bee products most used by the participants were honey (87.1%), followed by

propolis (33.1%), pollen (18.1%) and royal jelly (10.7%). 33.1% of the participants think that the use of bee products is good for the disease.

Table 3. Participants' use of bee products

		n	%
Being knowledgeable about bee products	Yes	404	62.0%
	No	248	38.0%
Bee products consumption status	Yes	440	67.5%
	No	212	32.5%
Honey consumption status	Yes	568	87.1%
	No	84	12.9%
Propolis consumption status	Yes	216	33.1%
	No	436	66.9%
Pollen consumption status	Yes	118	18.1%
	No	534	81.9%
Bee bread consumption status	Yes	25	3.8%
	No	627	96.2%
Royal jelly consumption status	Yes	70	10.7%
	No	582	89.3%
Bee wax consumption status	Yes	25	3.8%
	No	627	96.2%
When choosing bee products, be careful whether they are water-based or alcohol-based	Yes	282	43.3%
	No	370	56.7%
Using bee products because they are good for your illness	Yes	216	33.1%
	No	436	66.9%

p was calculated by chi-square test. Significant values are shown in bold (p < 0.05).

Dietary water, fluid and fiber intake of participants with and without constipation is shown in Table 4. A statistically significant relationship was found between constipation and fiber intake. The constipation percentage of fiber intake in the low

quartile (24.7%) was found to be higher compared to fiber intake in the other quartile.

Intake of dietary fiber, water, liquid and apitherapy products according to constipation status is shown in Table 5.

Table 4. Dietary water, fluid, and fiber intake of the participants with and without constipation.

	Constipated (n = 116)	Non-constipated (n = 536)	Prevalence of constipation (%)	p value
Water intake				
Lowest quartile (<800 mL/d)	16 (13.8%)	90 (16.8%)	15.1	0.677
Middle lower quartile (800-1200 mL/d)	34 (29.3%)	134 (25.0%)	20.2	
Middle upper quartile (1200-1600 mL/d)	26 (22.4%)	134 (25.0%)	16.3	
Highest quartile (>1600 mL/d)	40 (34.5%)	178 (33.2%)	18.3	
Total dietary fluid intake				
Lowest quartile (<1612 mL/d)	30 (25.9%)	132 (24.6%)	18.5	0.500
Middle lower quartile (1612-2145 mL/d)	24 (20.7%)	140 (26.1%)	14.6	
Middle upper quartile (2145-2696 mL/d)	28 (24.1%)	136 (25.4%)	17.1	
Highest quartile (>2696 mL/d)	34 (29.3%)	128 (23.9%)	21.0	
Dietary fiber intake				
Lowest quartile (<12.2163 g/d)	40 (34.5%)	122 (22.8%)	24.7	0.001
Middle lower quartile (12.2163-22.4081 g/d)	16 (13.8%)	148 (27.6%)	9.8	
Middle upper quartile (22.4081-37.1407 g/d)	36 (31.0%)	126 (23.5%)	22.2	
Highest quartile (>37.1407 g/d)	24 (20.7%)	140 (26.1%)	14.6	

Table 5. Amount of dietary fiber, water, fluid and apitherapy products intake of the participants with and without constipation.

	Constipated (n = 58)	Non-constipated (n = 268)	p value
Total dietary fiber (g)	23.9±18.66	26.5±17.88	0.174
Total fluid intake (mL)	2273.9±876.56	2194.17±1024.27	0.436
Water intake (mL)	1274.1±610.02	1323.2±888.88	0.408
Honey (g)	3.5±3.71	5.4±3.78	0.013
Propolis (g)	0.1±0.22	0.1±0.24	0.869
Pollen (g)	0.2±1.34	0.3±1.00	0.283
Bee bread (g)	0.1±0.30	0.1±0.87	0.133
Bee milk (g)	0.0±0.14	0.1±0.43	0.030
Bee wax (g)	0.0±0.14	0.0±0.40	0.056

Date are shown as the mean±standard deviation. p value was calculated by independent t-test. Significant values are shown in bold (p < 0.05)

Honey and royal jelly intake in the non-constipation group was found to be statistically significantly higher compared to the constipation group ($p < 0.05$). No statistically significant relationship was found between participants with and without constipation in terms of dietary fiber, fluid intake, water intake, propolis, pollen, bee bread and bee wax intake ($p > 0.05$).

DISCUSSION

Bees produce many products containing bioactive ingredients such as honey, propolis, royal jelly, bee pollen, beeswax and bee venom, which have been used in the treatment of various diseases by different civilizations for centuries.²⁷ In this study, we investigated the relationship of apitherapy products with constipation and the results we found were remarkable.

Constipation is a functional gastrointestinal disease that is common worldwide and can cause serious damage to quality of life as well as impose large socioeconomic burdens on both individuals and national health insurance.^{28,29} The 652 participants in this study were 70.6% male and 29.4% female, with an average age of 25.8 ± 9.53 years. Of the total cohort, 17.8% were diagnosed with constipation (19.1% of males, 14.6% of females). According to the results obtained in this study, no statistically significant difference was found between gender, smoking and physical activity status and constipation status ($p > 0.05$). A statistically significant relationship was found between constipation and age, BMI, education level and presence of chronic disease ($p < 0.05$).

It is reported that honey has effects in the prevention and treatment of gastrointestinal disorders such as peptic ulcer, gastritis and gastroenteritis. Regular consumption of honey increases the population of normal flora called bifidobacteria; Components of honey have been found to produce a prebiotic effect similar to the effect of fructooligosaccharides.³⁰⁻³² A study has shown that intestinal microbiota plays a role in alleviating loperamide-induced constipation in BALB/c mice with honey supplementation and can be considered as an evaluation parameter in constipation treatment strategies.³³ Another study found that participants using Sidr Honey had no recurrence of constipation during a one-year follow-up.³⁴ In another case, people diagnosed with inflammatory bowel syndrome (IBS) who experienced severe diarrhea or constipation, bloating, and stomach upset were shown to be successfully treated with raw Manuka honey on an

empty stomach.³⁵ In this study, similar to other studies, it was observed that individuals who consumed honey, the bee product most preferred by the participants, had statistically significantly less constipation ($p = 0.013$). Royal jelly contains a number of bioactive substances, including 10-hydroxy-trans-2-decenoic acid (10H2DA; “royal jelly acid”), which exerts an immunomodulatory effect.³⁶ In this study, individuals consuming royal jelly had statistically significantly less constipation ($p = 0.030$). The fact that individuals who consume honey and royal jelly experience less constipation suggests that consuming these foods may be beneficial in the treatment of constipation.

Recent research has shown that propolis not only has antioxidant effects due to the unique diversity of its components (especially polyphenols), but can also modulate inflammatory pathways, immune system function, intestinal microbiota, and GI permeability.^{37,38} In this study, propolis was found to be the second most consumed apitherapy product by the participants. Protective effects of the anti-inflammatory effect of bee venom on pathological mechanisms involved in liver injury³⁹ and airway inflammation⁴⁰ have been reported. Due to the way pollen is processed by bees, it becomes a product rich in enzymes and probiotics, making it beneficial for intestinal disorders such as ulcerative colitis, constipation and diarrhea, reducing inflammation and intestinal permeability. Bee bread is absorbed by the human body more efficiently than pollen, because the pollen envelope dissolves during processing, enhancing the absorption of vitamins.⁴¹ According to Bogdanov (2020), bee bread can improve digestion and intestinal disorders, as it is a source of probiotics that helps restore the intestinal microbiome, especially in patients undergoing colonoscopy or antibiotic treatment.⁴² Beeswax mainly contains hydrocarbons, free fatty acids, fatty acid esters and fatty alcohol, as well as exogenous substances such as pollen, propolis and flower components. Bee wax composition may vary between bees depending on genetic factors and diet.¹⁷ In this study, it was found that the consumption of propolis, bee venom, pollen, bee bread and bee wax did not significantly affect constipation. Low and irregular consumption of these products may also be effective in achieving this result.

The strength of the study is that there is no other study comparing the consumption of apitherapy products with constipation in Turkey. The limitation of the study may be the small sample size and the

exclusion of confounding factors more broadly.

CONCLUSION

The traditional knowledge provided by different civilizations regarding the application of bee products is extremely valuable and gives clues about their usefulness and preparation methods in the treatment and prevention of many diseases. While studies involving in vitro analyzes have revealed important findings regarding the biological properties and mechanisms of action of bee products, in vivo analyzes have also provided information about the pharmacological activities of bee products. In addition to in vitro and in vivo analyses, such studies are used as an important approach to question the usage areas of apitherapy products and investigate their effects on health. Clinical trials have shown that bee products are effective in treating a variety of diseases, both internal and external, but few articles have described the mechanisms of action of apitherapy products on constipation.

Apitherapy is practiced in some parts of the world. As a result of comprehensive information research,

it has been concluded that there is insufficient data regarding the prevalence of apitherapy or the use of bee products in treatment across different world regions. In order to make further progress in our knowledge of bee products, the acquired knowledge must be more easily accessible for the benefit of humanity. Therefore, in order to benefit from bee products and their potential and standardize their use, it is of great importance to strengthen the exchange of information between beekeepers, researchers, apitherapists, nutritionists, doctors, sellers and consumers, and to share the results in scientific and alternative activities.

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