

## DETERMINATION OF ENERGY VALUES OF BEE PRODUCTS MIXED WITH HERBAL SOURCES AS A PERFORMANCE-ENHANCING ENERGY SOURCE FOR SPORTSMEN

<sup>1</sup>Nevzat ARTIK<sup>ABCDE</sup>

<sup>2</sup>Mehmet Rüştü KARAMAN<sup>ABCDE</sup>

*A Çalışma Deseni (Study Design)*

*B Verilerin Toplanması (Data Collection)*

*C Veri Analizi (Statistical Analysis)*

*D Makalenin Hazırlanması (Manuscript Preparation)*

*E Maddi İmkanların Sağlanması (Funds Collection)*



**Abstract:** Athletes should consume a wide variety of foods that meet their energy needs and provide optimum amounts of carbohydrate, protein, fat, vitamins, minerals and other important food components. Especially, carbohydrates are the most essential nutrient in an athlete's diet because they are the only fuel that can sustain intense exercise for extended durations. It is believed that bee products such as honey, propolis, royal jelly, bee pollen and bee bread are the best supplements for human nutrition and health, but there is limited information on the ergogenic effects of bee products on sports performance. The main target of this study was to analyse some energy components, minerals, vitamins etc. of bee products such as perga vital to determine their potential as a performance-enhancing energy sources for athletes. Perga vital is a raw honey, pure perga (bee bread), pollen, carob powder black grape seed powder mixture, especially developed as a natural food according to scientific norms in Technopark Region of Ankara University. For this aim, energy values (kcal/kJ per 100 g), protein (%), fat (%), carbohydrates (%), fiber (%), sucrose (%), glucose (%), fructose (%), glucose + fructose (%), moisture (%), water-insoluble matter (g 100g<sup>-1</sup>), Naphthalene, mg kg<sup>-1</sup>HMF (mg kg<sup>-1</sup>), free acidity (meq kg<sup>-1</sup>), number of diastas, total phenolics (mg 100g<sup>-1</sup>) and antioxidant capacity (mg 100 g<sup>-1</sup>) of perga vital were analysed according to the routine methods. The findings have revealed that bee products have an abundance of vitamins, minerals, enzymes and phytonutrients, which are all important in achieving optimal health and performance of athletes. Furthermore, perga vital can be an effective carbohydrate source and a better substitute to glucose for exercise and athletic performance, due to its constituent of various classes of sugars. However, standardisation of quality properties of the bee products such as perga vital will be valuable for their optimal performance effects for sportsmen.

**Key Words:** Bee products, Perga vital, Athletes, Nutrition, Performance

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## 1. INTRODUCTION

Genetic ability and training level in international sporting competitions are very similar between the athletes to win and lose is now determined in milliseconds. Therefore, athletes and coaches are always in search of a high performance. Among athletes in general there is a tendency to use many substances, ergogenic aids to improve aerobic performance in an unconscious manner (Williams, 1983; Erdemir et al., 2005). Athletes should also consume a wide variety of foods that meet their energy needs and provide optimum amounts of carbohydrate, protein, fat, vitamins, minerals and other important food components. Especially, carbohydrates are the most essential nutrient in an athlete's diet because they are the only fuel that can sustain intense exercise for extended durations. Proper nutrition, sufficient carbohydrates and fluids are of course important during and before the race. However, Williams, M. H., (1992) stated that genetic structure and appropriate training endurance and high endurance are the main factors in the success of the athlete.

The energy requirements of training vary according to the type and duration of sessions which in turn change across training cycles. Bee products include honey, propolis, royal jelly, bee pollen and bee bread consists mainly of carbohydrates (CHO), minerals, and vitamins which are properties that are believed able to improve exercise performance and general health. Bee products have an extraordinary nutrient richness and have numerous bioactive compounds that can effectively protect our health against more than 500 diseases. For example, in the composition of honey; proteins, carotenoids, organic acids, amino acids, minerals, vitamins, enzymes, and phenolic acids and flavonoids. Another important bee product, propolis; It consists of at least 300 biological compounds, including resin, wax, essential oils, pollen and other organic compounds (phenolic compounds, esters, flavanoids, terpenes, aromatic aldehydes, etc.). In the composition of royal jelly, proteins, carbohydrates, lipids, minerals, vitamins, amino acids and a number of biologically active substances, including immunoregulatory and antibacterial proteins, fatty acids and peptides (Doğaroğlu, 2018).

Honey has been an important component of athletic nutrition for thousands of years. As early as 400 B.C., Greek athletes are known to have used honey both for energy during competition, and as an aid in recovering from competition. It's no secret that carbohydrates are a valuable source of energy for athletes. Loading up on carbohydrates before an athletic competition is a common practice. And often, some form of carbohydrate is consumed *during* competition as well. Consuming carbohydrates after exercising is also important to *replenish glycogen* in the muscles and liver. Honey is a particularly valuable carbohydrate source because of its composition of nearly equal parts of fructose and glucose. The glucose in honey is absorbed by the body quickly and gives an immediate energy boost, whilst the

fructose is absorbed more slowly providing sustained energy delivery. The value of honey as a carbohydrate for athletes was demonstrated in three separate trials conducted by the University of Memphis Exercise and Sport Nutrition Laboratory. The trial showed that honey outperformed placebos, and *outperformed or equaled all* popular carbohydrate sources it was tested against, including dextrose, maltodextrin, and a popular carbohydrate gel. In most cases, honey improved power, speed, and endurance. Honey also sustained blood sugar levels consistently for longer periods of time, and resulted in greater stability of blood sugar and blood insulin levels (Anonymous, 2019).

Erdemir et al (2005) searched the effect of single dose pollen loading on maximal oxygen consumption and blood parameters in durability sportsmen. The aim of this study was to determine the resistance of bee pollen loading to max. The effects of VO<sub>2</sub> and blood parameters (cholesterol, glucose, triglyceride, HDL-C, LDL and total protein) were investigated. As a result of the measurements, it was found that bee pollen loading increased maximal oxygen consumption (p <0.04) and distance traveled in 12 minutes run-walk test (p <0.04). Bee bread is characterized by a higher nutritional value than pollen, better digestibility, and richer chemical composition. Moreover, it is better absorbed by the human body than pollen since the components of bee bread are partially fermented and are more easily assimilated in an organism (Kielizsek et al., 2017). Because of the presence of all the essential amino acids, bee bread is characterized by better composition than many valuable products obtained based on animal proteins. Bee bread also has good properties that help eliminate various toxins from organism (Habryka et al., 2016). Bee bread or perga, is a naturally fermented, enzymatically-activated food made by bees inside the hive, with around 25% honey or nectar, 70% pollen, and 5% mixture of bee wax and enzymes. In the process of fermentation, microorganisms conserve the pollen and convert it into bee bread. Considered far superior to flower pollen, protein bioavailability is significantly enhanced. The fermentation process not only helps preserve the pollen's shelf life, but also amplifies the bioavailability of its nutrients, which makes it much more important as a food supplement than the pollen.

Bee products also have a high antioxidant source and natural antibiotic properties (Nakajima et al., 2009). As a result of beekeeping activities, very important products are produced for human health. Although the use of beekeeping products for treatment purposes is based on ancient times, it continues to be up-to-date with the research and establishment of apitherapy centers (Viuda et al., 2008; Doğaroğlu, 2018). It is believed that bee products are the best supplements for human nutrition and health, but there is limited information on the ergogenic effects of bee products on sports performance.

## 2. MATERIALS AND METHODS

The main target of this study was to analyse some energy components, minerals, vitamins etc. of bee product of perga vital to determine their potential as a performance-enhancing energy sources for athletes. Perga vital is a raw honey, pure perga (bee bread), pollen, carob powder black grape seed powder mixture, especially developed as a natural food according to scientific norms in Technopark Region of Ankara University. This product is completely natural and has maximum bio effect. It contains amino acids, enzymes, hormones, minerals, vitamins in large amounts and types (Ivanisova et al., 2015; Karaman et al., 2016). In this study, energy values (kcal/kJ per 100 g), protein (%), fat (%), carbohydrates (%), fiber (%), sucrose (%), glucose (%), fructose (%), glucose + fructose (%), moisture (%), water-insoluble matter (g 100g<sup>-1</sup>), Naphthalene, mg kg<sup>-1</sup> HMF (mg kg<sup>-1</sup>), free acidity (meq kg<sup>-1</sup>), number of diestas, total phenolics (mg 100g<sup>-1</sup>) and antioxidant capacity (mg 100 g<sup>-1</sup>) of perga vital were analysed according to the routine methods (Anonymous, 2005). Nutrition status of perga vital have also investigated. For all quality analysis were made by using routine methods. The values obtained from analysis were compared to the limit values reported by Agricultural Ministry.

## 3. RESULTS AND DISCUSSION

Some quality and energy properties of perga vital produced from Turkish bee products was presented in Table 1 and 2, respectively. The findings have revealed that bee products have an abundance of total phenolics and antioxidant, which are all important in achieving optimal health and performance of athletes (Macdermid and Stannard, 2006; Dubtsova et al., 2007; Yakusheva, 2010; Ping et al., 2018).

**Table 1.** Some quality properties of Perga Vital

Parameters	Mean ± SD	TFK
Moisture, %	16.5 ±	Max. 20
Free Acidity, meq kg <sup>-1</sup>	1.28 ±	Max. 50
Water-insoluble matter, g 100g <sup>-1</sup>	0.29 ±	-
EC, mS cm <sup>-1</sup>	0.50 ±	Max. 0.8
Sucrose, %	1.21 ±	Max. 5
Fructose + Glucose, %	6.23 ±	Min. 50
Fructose / Glucose	64.1 ±	1.10-1.14
Number of Diestas	10.15 ±	Min. 8
Antioxidant, mg 100g <sup>-1</sup>	79.54 ±	-
Total Phenolics, mg 100g <sup>-1</sup>	26.23 ±	-
Naphthalene, mg kg <sup>-1</sup>	0.00 ±	Max. 10

HMF, mg kg <sup>-1</sup>	6.90 ±	Max. 40
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**Table 2.** Some energy values of Perga Vital

Parameters	Mean ± SD
Energy, (kcal/kJ)/100 g	376/1572
Protein, g	8.23
Fat, g	1.15
Carbohydrate, g	81.03
Fiber, g	23.1

Furthermore, honey can be an effective carbohydrate source and a better substitute to glucose for exercise and athletic performance, due to its constituent of various classes of sugars (Markiewicz-Żukowska, et al., 2013). Although honey is a high carbohydrate food, its glycemic index varies within a wide range from 32 to 85, depending on the botanical source, which make it an excellent energy source especially for children and sportsmen (Stanciu et al., 2009; Yusof et al., 2018). On the other hand, many studies have also revealed long term ingestion of pollen and special pollen preparations could improve the physical performance and fitness of sportsmen and elderly people. The data obtained from the Sports Nutrition and Exercise Laboratory of one University showed that honey could also be used effectively instead of glucose for energy replenishment during physical exercise (Macdermid and Stannard, 2006). Supplementation of perga vital will also elicit an ergogenic effect on running time trial performance in recreational athletes due to their rich capacities of many nutrients, minerals, and enzymes. However, the analysed values of samples were varied depending on variety of bee products or their mixtures (Bobis et al., 2010).

#### 4. CONCLUSION

Bee products have been used thousands of years ago as a natural supplement and as a form of traditional medicine. However, there are many bee-products on the market, many of which are very poor quality with very suspect ingredients that is also contaminated with antibiotics, heavy metals and other impurities. Standardisation of quality properties of the bee products will be valuable for their optimal performance effects for athletes. The findings have revealed that bee products have an abundance of vitamins, minerals, enzymes and phytonutrients, which are all important in achieving optimal health and performance of athletes. Furthermore, perga vital having herbal sources such as carob powder and black grape seed powder mixture can be an effective carbohydrate source and a better substitute to glucose for exercise and athletic performance, due to its constituent of various classes of sugars. This bee

mixture have also a high antioxidant source and natural antibiotic properties that is important to prevent many health problems. However, standardisation of quality properties of the bee products will be valuable for their optimal performance effects for athletes.

## 5. REFERENCES

Anonymous, (2005). *Turkish Food Codex - Honey Notification* (Number: 2005/49) - Official Newspaper, Ankara, Turkey.

Anonymous, (2019). <http://www.bees-and-beekeeping.com/athletic-nutrition.html>

Bobis, O., Marghitas, L.A., Dezmiorean, D., Morar, O., Bonta, V. & Chirila, C. (2010). Quality parameters and nutritional value of different commercial bee products. *Bulletin of University of agricultural sciences and veterinary medicine Cluj-Napoca. Animal Sci. and Biotech.*, Vol. 67:1-2.

Doğaroğlu, M. (2018). *Modern arıcılık teknikleri, arıcılıkta başarının yolları* (7. Baskı-Son baskı). Tekirdağ: Tekirdağ yayınevi.

Dubtsova, E., Komisarenko, I. & Kassyanenko, V. (2007). Bee pollen and bee bread: Biological action and use in aged people. *C. Gerontol* 13, 50-52.

Erdemir, İ., Zorba, E., Işık, O. & Savucu, Y. (2005). Tek doz polen yüklemesinin dayanıklılık sporcularında maksimal oksijen tüketim ve kan parametrelerine etkisi. *Fırat Üniversitesi Sağlık Bilimleri Tıp Dergisi*, 19(3), 185-191.

Habryka, C., Kruczek, M. & Drygas, B. (2016). Bee products used in apitherapy. *World Scientific News*, 48, 254-258.

Ivanisova, E., Kacaniova, M., Francakova, H., Petrova, J. & Hutkova, J. (2015). Bee bread-perspective source of bioactive compounds for future. *Potravinarstvo Scientific Journal for Food Industry* 9(1), 592-598.

Karaman, M. R., Artık, N. & Küçükersan, K. (2016). *Perga (Bee Bread) composition and health benefit*. The 2<sup>nd</sup> International Turkic World Conference on Chemical Sciences and Technologies, Skopje, Macedonia on October 26-30.

Kielizsek, M. et al. (2018). Pollen and bee bread as new health-oriented products: A review. *Trends In Food Science & Technology*, 71, 170-180.

Markiewicz-Żukowska, R., Naliwajko, S.K., Bartosiuk, E., Moskwa, J., Isidorov, V., Soroczyńska, J. & Borawska, M.H. (2013). Chemical composition and antioxidant activity of beebread, and its influence on the glioblastoma cell line (U87MG). *Journal of Apicultural Science* 57(2), 147-157.

Macdermid, P. W. & Stannard, S. R. (2006). A whey-supplemented, high-protein diet versus a high-carbohydrate diet: effects on endurance cycling performance. *Int J Sport. Nutr. Exerc. Metab*, 16(1), 65-73.

Nakajima, Y., Tsuruma, K., Shimazawa, M., Mishima, S., & Hara, H. (2009). Comparison of bee products based on assays of antioxidant capacities. *BMC Complement Alter. Med*, 9, 4-10.

Ping, F. W., Chen, C. K., Ooi, F. K. & Mohamed, M. (2018). Effects of bee bread supplementation on endurance running performance and total antioxidant status in recreational athletes. *International J. of Applied Research in Natural Products*, 11(1), 17-23.

Stanciu, O., Marghitas, L. & Dezmirean, D. (2009). Macro-and oligo-mineral elements from honeybee-collected pollen and bee bread harvested from Transylvania (Romania). *J Anim. Sci. Biotechnol*, 66, 1-6.

Viuda-Martos, M., Ruiz-Navajas, Y., Fernández-López, J. & Pérez-Alvarez, J. (2008). Functional properties of honey, propolis, and royal jelly. *J Food Sci*. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/19021816>.

Williams, M. H. (1983). Ergogenic aids in sport. Champaign, IL: Human Kinetics.

Williams, M. H. (1992) Ergogenic and ergolytic substances. *Medicine and Science in Sports And Exercise*, Baltimore, Md. September, 344-348.

Yakusheva, E. (2010). *Pollen and bee bread: Physico-chemical properties. Biological and pharmacological effects*. In Medical Practice, In Rakita, D., Krivtsov, N., Uzbekova, D.G. (Eds.). *Theoretical and Practical Basics of Apitherapy (Russian)*. Roszdrav: Ryazan.

Yusof, A., Ahmad, N. S., Hamid, A. & Khong, T. K. (2018). Effects of honey on exercise performance and health components: A systematic review. *Sci. & Sports*. Doi: 10.1016/j.scispo.2018.02.007.