ISSN: 2394-1391

Review Article

Indian Journal of Biology
Volume 9 Number 2 / July - December 2022
DOI: http://dx.doi.org/10.21088/ijb.2394.1391.9222.7

Honey for Nutrition and Health Benefits - Traditional and Modern Uses in Human Diseases: A Review

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How to cite this article:
R Padmavathi, P Sethuraj, P S Rathipriya/Honey for Nutrition and Health Benefits - Traditional and Modern Uses in Human Diseases: A Review/Indian J Biol 2022; 9(2):75–86.

Abstract

About 95% of the honey dry matter is composed of carbohydrates, mainly fructose and glucose. 5 to 10% of the total carbohydrates are oligosaccharides, in total about 25 different di and trisaccharides. The Glycemic Index of honey varies from 32 to 85, depending on the botanical source which is lower than sucrose (60 to 110). Fructose rich honeys such as acasia honey have a low GI. Honey contains small amounts of protein, enzymes, amino acids, minerals, trace elements, vitamins, aroma compounds and polyphenols. Honey has been shown to process anti microbial, antiviral, antiparasitory, anti-inflammatory, antioxidant, antimutagenic and antitumor effects. Due to its high carbohydrate content and functional properties honey is an excellent source of energy for athletes. Most of the health promoting properties of honey is only achieved by application of rather high doses of honey such as 50 to 80 grams per intake.

Keywords: Honey; Human Diseases; Traditional; Modern Medicines.

INTRODUCTION

Honey is a natural product formed from nectar of flowers by honeybees (Apis mellifera; Family: Apidae). Honey has been used by humans since ancient times, nearly 5,500 years ago. Most ancient population, including the Greeks, Chinese, Egyptians, Romans, Mayans and Babylonians consumed honey both for nutritional aims and for its medicinal properties. Honey is the only insect-derived natural product and it has nutritional, cosmetic, therapeutic, and industrial values. Honey is reviewed as a balanced diet and equally popular for male and female in all ages. Honey no needs to refrigerate, it never spoils and it can also be stored unopened at room temperature in a dry place. The water activity (WA) of honey is between 0.56 and 0.62 and its value of pH is almost 3.9. Honey was utilized as a natural sweetener from ancient period since it has high level of fructose (honey is 25% sweetener than table sugar). Moreover, the use of honey in beverages is also increasingly popular.

Nowadays, information on the usage of honey for the cure of many human diseases can be found in general magazines, journals, and natural products leaflets and suggesting a wide variety of unknown activities. Evidence indicates that honey can exert several health beneficial effects including antioxidant, anti-inflammatory, anti-bacterial, anti-diabetic respiratory, gastrointestinal, cardiovascular, and nervous system protective

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Received date: 14.07.2022

Accepted date: 17.08.2022

effects. Although many investigations were done on honey, only a few are published. This study, which is a comprehensive review of the current literature, highlights the therapeutic benefits of honey in the management of diseases. As the only available natural sweetener honey was an important food for Homosapiens from his very beginning. Indeed, the relation between bees and manstarted as early as Stone Age. In order to reach the sweet honey, man was ready to risk his life.

SURVEY ON NUTRITIONAL AND HEALTH ASPECTS OF HONEY

However, as they are not complete and comprehensive, we undertook the task to review all the available relevant sources on this topic:

COMPOSITION

The overall composition of honey is shown in Table.The carbohydrates are the main constituents, comprising about 95% of the honey dry weight. Beyond carbohydrates, honey contains numerous compounds such as organic acids, proteins, amino acids, minerals, polyphenols, vitamins.

Carbohydrates

The main sugars are the monosaccharides fructose and glucose. Additionally, about 25 different oligosaccharides have been detected In the process of digestion after honey intake the principal carbohydrates fructose and glucose are quickly transporter into the blood and can be utilized for energy requirements by the human body. A daily dose of 20g honey will cover about 3% of the required daily energy (Table).

Proteins Enzymes and Amino Acids

Honey contains roughly 0.5% proteins, mainly enzymes and free amino acids. The contribution of that fraction to human protein intake is marginal (Table). The three main honey enzymes are diastase(amylase), decomposing starch or glycogen into smaller sugar units, invertase (sucrose,α-glucosidase), decomposing sucrose into fructose and glucose as well as glucose oxidase, producing hydrogen peroxide and gluconic acid from glucose.

Vitamins Minerals and Trace Compounds

The amount of vitamins and minerals is small and the contribution of honey to the recommended daily intake(RDI) of the different trace substances is marginal (Table). It is known that different unifloral honeys contain varying amounts of minerals and traced elements. From the nutritional point of view chromium, manganese and selenium are important, especially for 1 to 15 years old children. The elements sulphur, boron, cobalt, fluoride, Iodide, molybdenum and silicon can be important in human nutrition too, although there are no RDI values proposed for these elements (Table). Honey contains 0.32-25 mg/kg choline and 0.06 to 5 mg/kg acetylcholine (Molan, P:2001).[12] Choline is essential for cardiovascular and brain functional as well as for cellular membrane composition and repair, while acetylcholine acts as a neurotransmitter.

Contaminants and Toxic Compounds in Honey

The same as any other natural food, honey can be contaminated by the environment, e.g. by heavy metals, pesticides, antibiotics etc. The main problem in recent years was the contamination by antibiotics, used against the bee brood diseases, but at present this problem seems to be under control. European Union antibiotics are not allowed for that purpose, and thus honey containing antibiotics is also not permitted to be traded on the market. A few plants used by bees are known to produce nectar containing toxic substances. Diterpenoids and pyrrazolidine alkaloids are two main toxin groups relevant in nectar.some plants of the Ericaceaae family belonging to the sub-family e.g. Rhododendron ponticum contain toxic polyhydroxylatedcyclic hydrocarbons or diterphenoids (Arcot j.and Brand-Millet, 2007).[36]

The substances of the other toxin group,the pyrrazolidine alkaloids, found in different honey types and the potential intoxication by these substances is reviewed (Foster-Powell. K and Holt, 2002).[37]

DIFFERENT PSYSIOLOGICAL EFFECTS; HONEY

Antimicrobial, Antiviral And Antiparasitic Activity

Honey inhibits the growth of micro-organisms and fungi. The antibacterial effect of honey, mostly against gram-positive bacteria, is well documented (Mohan. PC,1992, Zeina. B, et al.,1997).[60] Both bacteriostatic and bactericidal effects have been reported for many strains, many of them pathogenic. Further, it was reported that honey also been shown to inhibit Rubella virus in vitro,three species of the Leishmania parasite (White, et al., 1963)[65] and Echinococcus (Dustmon. J, 1971).[66]

Antimicrobial effect of honey

The antimicrobial effect of honey is due to different substances and depends on the botanical origin of honey (Mohan. PC, 1992, Zeina.B, et al., 1997).[60] The lower water activity of honey inhibits bacterial growth. Honey glucose oxidase produces the antibacterial agent hydrogen peroxide (Russell. K.M, et al., 1988)[67], but the peroxide production capacity depends also on honey catalase activity (Cushnie.T, and Lamb., 2005).[68] There are also other non-peroxide antibacterial substances with different chemical origin, e.g. aromaticacids (Weston.RJ, et al., 1999)[69], unknown compounds with different chemical properties (Zeina.B, et al., 1997) and phenolics andflavonoids (Yatsunami.K and Echiago, (1984)[70], Ames.BN, et al.,1993).[71] The low honey pH can also be responsible for the antibacterial activity Contrary to the non-peroxide activity, the peroxide one can be destroyed by heat, light and storage (Zeina.B, et al.,1997).[63] These different factors had a bigger effect on the antibacterial activity of blossom honey than on honeydew honey.

ANTIMUTAGENIC AND ANTITUMOR ACTIVITY

Its possible mode of anti-tumor action was studied by the application of honey in spontaneous memory carcinoma in methylcholanthrene-induced fibrosarcoma of CBA mice and in anaplastic colon adenocarcinoma of Y59 rats.

A statistically significant anti-metastatic effect was achieved by oral application of honey. These findings indicate that honey activates the immune system and honey ingestion maybe advantageous with respect to cancer and metastasis prevention. Another study of the same group the effect of honey on tumour growth, metastasising activity and induction of apoptosis and necrosis in murine tumor models(mammary and colon carcinoma was investigated (Bilsel.Y, et al., 2002).[96] A pronouncedantimetastatic effect was observed when honey was applied before tumor-cell inoculation (per oral 2 kg-1 for miceor 1g kg-1 for rats, once a day for 10 consecutive days). In another study the anti-tumour effect of honey against bladder cancer was examined in vitro and in vivo in mice (Postmes.T., 2001).[97] It results honey is an effective agent for inhibiting the growth of different bladder cancer cell lines (T24, RT4, 253J and MBT-2) in vitro.

An intake of 50 g honey of unspecified type by healthy people and diabetes patients led to smaller increases of blood insulin and glucose than the consumption of the same amounts of glucose or of a sugar mixture resembling to honey (Peretti. A, et al., (1994)[44], Al-Wailli, N.S, 2004).[45] It was shown that consumption of honey has a favourable effect on diabetes patients, causing a significant decrease of plasma glucose (Al-Waili, NS:(2003)[46], Bornet, F, et al.,1985).[48] Honey was well tolerated by patients with diabetes of unspecified type (Katsilambros. NL, et al.,1988)[49] and by diabetes type-2 patients [Samanta. A et al.,(1985)[50], Pi-Sunyer.FX.,2002].[52] According to recent studies, long-term consumption of food with a high GI he said significance risk factor for type 2 diabetes patients (Elliott SS. et al.,2022).[53] However, the GI concept for the general population is still an object of discussions (Busserolles.J, et al.,2002).[54]

Fructose is the main sugar in most honey types (Table). A surplus consumption of fructose in today's American diet, mainly in the form of high-fructose corn syrup, is suspected to be one of the main causesfor overweight problem (Yamada.S, et al; 1999).[55]

ANTIOXIDANT CAPACITY OF HONEY

Antioxidants, which are either naturally synthetized in situ, or externally supplied through foods, and/or supplements (Pham-Huy et al. 2008). Research indicates that foods rich in antioxidants such as honey can protect from the damaging effects of free radicals and ROS and thus exhibit beneficial effects on human health; such as cardiovascular protection by preventing ROS-induced low density lipoprotein(LDL) oxidation (Schramm et al. 2003)[83]; (Ajibola 2015). For instance in animal models, honey showed a protective effect against damage and oxidative stress induced by cigarette smoke honey supplementation exhibited a hepatoprotective and nephroprotective effect in rats with experimental aflatoxicosis due to its antioxidant activity (Yaman et al. 2016).[55] The antioxidant capacity of honey is commonly attributed to its phenolic compounds. Exhibit several preventive effects against different diseases like cancer, cardiovascular disease, inflammatory disorders, neurological degeneration, wound healing, infectious diseases and aging (Khalil et al.2010).[29]

Schramm et al.(2003)[83] observed that honey fed at 1.5 g/kg body weight increased both phenolic antioxidants and plasma antioxidant capacity inhealthy human subjects. These results supported the concept that phenolic antioxidants from honey are bioavailable and that these compounds may

argument oxidative defense in the human body observed by (Gheldof et al.2003).[31] The antioxidant activity of phenolic compounds is related to a number of different mechanisms, such as free radical-scavenging hydrogen-donation, singlet oxygen quenching and/or metal ion chelation (Eteraf-oskouei and Najafi 2013).[26] The antioxidant capacity of honey is generally measured by use of various in vitro assays such as: in the form of antiradical activity using 1,1-diphenyl-2–picrylhydrazyl (DPPH) scavenging assay; 2,2′-azino-bis (3-ethylbenzothiazoline -6- sulphonic acid) (ABTS) assay; measures the conversion by antioxidants of the oxidized form of ion (Fe3+) to the reduced form (Fe2+) (Erejuwa et al. 2012). Several in vitro studies showed that the antioxidant capacity is strongly correlated with the content of the total phenolics in honey (Chua et al.2013; Sani et al. 2005).[32] For instance, a positive correlation was found between antioxidant capacity(ORAC assay) and TPC of various commercial honeys.

Antibacterial Activity of Honey

The treatment of bacterial infections is being increasingly complicated by the ability of bacteria to develop resistance to current available antimicrobial agents. This evidence leads to the need of less and better use of antibacterials and antifungals, improved infection control and research on new therapeutic compounds (White et al.1963).[65] Antibacterial activity of honey is one of the most important findings that were first recognized in 1892. The recent research indicates that the effectiveness of honey in many of its medical uses is due to its antibacterial activity that is capable of inhibiting Gram- positive and Gram-negative bacteria, including multidrug resistance strains (Bogdanov.S. et.al(2003).[61]

Anti-Inflammatory Activities of Honey;

Honey processes quite a large number of therapeutic properties, including antioxidant and antimicrobial properties, as well as anti-inflammatory activity. The main evidence that considers the antioxidant activity as the anti-inflammatory factor is the ability of antioxidants to inhibit ROS production during the inflammatory process. A number of drugs are available for the treatment of ulcerative colitis. Manuka honey has been shown to specifically decrease the inflammatory response associated with ulcerative colitis, an inflammatory bowel disease characterized by an over-expression of inflammatory cells Junie et al.(2016)[27] compared in vitro antibacterial activity of several types of honey or different origins against the bacterial resistant strains isolated from patients, including pseudomonas aeruginosa, Escherichiacoli, Staphylococcus aureus, Staphylococcus epidermidis, Salmonella enteric serovar Typhyimurium, Bacillus ceraus, Bacillus subtilis and Listeria monocytogenes.

According to Bogdanor. S. et al. (2007)[29], antibiotics tested (cefazolin, oxacillin, vancomycin, azithromycin,fusidicacid,gentamicin,andlinezolid) were not bactericidal to methicilins-sensitive Staphylococcus aureus, methicillin-resistant Staphylococcus aureus (MRSA), or Pseudomonas aeruginosa (PA) biofilms. But the bactericidal rates for the sidr and Manuka honeys were significantly higher than those seen with the single antibiotics. Thus the use of honey in a medical sitting is considered to be helpful in combating bacterial resistance (Kwakman et al.2008). The bacterial strains differ in their sensitivity to honeys. Due to the different floral source, locations, bee species, storage (time and temperature), and processing, the antibacterial potency of different honeys can vary, for some by more than 100-fold (Biswal, B.M et.al (2003).[63] This it is difficult to standardize honeys and assess their usefulness in a medical application (Sous et al.2016). Inspite of this, there are medical grade honeyslike Revemilsource (RS) honey and Manuka (i.e., Medihoney). Having reproducible antibacterial activity, these honeys are produced under controlled conditions in greenhouses and each batch is analyzed individually to assess the Unique Manuka Factor (UMF) gives a number based on its bactericidal activity. These pro-inflammatory cytokines stimulate nitric oxide production (NO), an important mediator of inflammation (Jenkins.D, et.al (2002).[41]

HONEY HEALTH BENEFITS AND USES IN MEDICINE

Wound Healing Activity

Several animal studies and clinical trials have

examined the application of honey for acute and chronic wounds (Muller et al. 2000)[65] including burn injuries (Bangroo et al. 2005), and have demonstrated that it limits the amount of edema, improves granulation and epithelization in the proliferative phase while decreasing total wound healing time, reduces scarring and contractures inpatients with burn wounds Due to its low adherence in wound surface, honey causes minimal pain during application and upon removal preserving the newly forming granulation tissue (Pi. Sunyer Fx (2002).[27] There is evidence that honey can heal partial thickness burns more quickly (around 4-5 days) and post-operative infected wounds can be treated by honey more effectively than by use of antiseptic or gauze (Jones R(2001)[2], a total of 12 patients with chronic footulcers utilized natural honey as an effective alternative to more expensive, advanced wound products.

After the wound rinsing with normal saline, natural honey was applied and the wound was covered by glycerin impregnated gauze. Patients were followed on a daily basis for an average of 4 weeks. The results showed that all ulcers healed with no contractures or scars with a mean healing time of 3 weeks. Moreover, there was a 75% reduction in the dressing budget of the health center and a high level of satisfaction among both health professionals and patients. Also, patients'pain levels were reduced significantly after using natural honey observed when Manuka honey gel was used for treatment of partial-thickness facial burns. The healing time was congruent with or better than what would been expected with standard treatment. No abnormal bacterial growth was reported and the patients reported overall satisfaction with the treatment and cost of the treatment. It has been suggested that Manuka honey is a clinically and economically valuable treatment (Khotkina, M. 1955).[57]

In addition a recent study by (Postmes.T. 2001)[45] showed that honey dressings can promote better results for burn wounds than the silver-based dressings (i.e., silver sulfadiazine), the currently extensively used method used to treat a variety of acute and chronic wounds.

Honey Facilitates Wound Healing

Honey facilitates wound healing by its ability to create an effective viscous barrier on the wound surface, the invasion of microorganisms (Postmes. T. 2001)[45] present in the wounds and can remove any dead tissue that may provide a favorable environment for the growth of microorganisms (Khatkina V, 1855).[57] The acidic pH of honey (3.2 to 4.5) inhibits growth of most pathogenic bacteria within wounds, and increases production of hydrogen peroxide from the enzyme glucose oxidase at 1: 1000 concentration. This is less than the conventional rinse solutions but enough to inhibit bacterial growth without compromising the new granulation tissue. Thus, when applied topically, honey is capable of cleaning infection from a wound and improving healing (Al-waili et al. 2004).[46]

OPHTHALMOLOGY AND HONEY

Honey is Used worldwide for the treatment of various ophthalmological conditions like blepharitis, keratitis, conjunctivitis, corneal injuries, chemical and thermal burn to ice 4581 In one study with topical application of honey as ointment in 102 patients with non-respective eye disorders improvement was seen in 85% patients and in remaining 15% there was no disease progression application of honey in the infected conjunctivitis reduced redness swelling post discharge and the time to bacterial eradication 32 78 80. Honey and diabetes the use of honey in type 1 and type 2 diabetes for associated with significantly lower glycermic index then with glucose or sucrose in normal diabetes honey compared with dextrose death significantly lower rise in plasma glucose levels in diabetic subjects it also casts the reduction of blood lipids homosystem levels and sea reactive protein CRP levels in normal and hyperlipidemic subjects In earlier observations It was found that Honey stimulates insurance secretion decrease blood glucose levels elevates hemoglobin concentration and improves lipid profile 13 (Isthayek. et. al 2006).[13]

TRADITIONAL AND MODERN USES OF NATURAL HONEY IN HUMAN DISEASES:

Honey In Indian System of Ayurveda

Ayurveda is a compound word i.e., ayus meaning 'life' or 'life principle', and the word veda, which refers to 'a system of knowledge'. Hence 'Ayurveda' roughly translates as a 'knowledge of life'. The ancient vediccivilization considered honey one of nature's most remarkable gifts to mankind. Traditionally, according to the texts of Ayurveda, honey is a boon to those with weak digestion. Also it has been emphasized that the use of honey is highly beneficial in the treatment of irritating cough. Honey is regarded by Ayurvedic experts, as valuable in keeping the teeth and

gums healthy. It has been used for centuries for the treatment of insomnia because it has hypnotic action. Additionally, traditional Ayurvedic experts interventions targeted at decreasing ROS generation may also be used as an adjunct to conventional diabetes therapy.

HONEY AND CANCER

Current studies shows that honey may exert anticancer effects through several mechanisms. Investigations have indicated that honey has anticancer property through its interference with multiple cell signaling pathways, including inducing apoptosis, antimutagenic, anti-proliferative, and anti-inflammatory pathways. Honey modifies the immune responses. Honey has been indicated to prevent cell proliferation, induce apoptosis, modify cell cycle progression, and cause mitochondrial membrane deplorization in several types of cancer such as skin cancer cells (melanoma), adenocarcinoma epithelial cells, cervical cancer cells, endometrial cancer cells, liver cancer cells, colorectal cancer cells, prostate cancer cells, renal cell carcinoma, endometrial cancer cells, liver cancer cells,colorectal cancer cells,human nonsmall cell lung cancer, bone cancer cells (osteosarcoma), and leukemia and mouth cancer cells (oral squamous cell carcinoma). In addition, honey could be able to inhibit several forms of tumor in animal modeling including breast cancer, carcinoma, melanoma, colon carcinoma, hepatic cancer, and bladder cancer. However, more studies are needed to improve or understanding of the positive effect of honey and cancer.

Honey and Asthma

Honey is commonly used in folk medicine to treat inflammation, cough and fever. The ability of honey to act in reducing asthma related symptoms or as a preventive agent to preclude the induction of asthma was showed. Chronic bronchitis and bronchial asthma were treated by oral honey consumption in animal modeling. Inhalation of honey was also discovered to effectively remove mucus-secreting goblet cell hyperplasia. However, future studies are needed to investigate these effects of honey to better understand the mechanisms by which honey reduces asthma symptoms.

Honey and Cardiovascular Diseases

Antioxidants present in honey such as flavonoids, polyphenolics, Vitamin C, and monophenolics may be associated with a reduced risk of cardiovascular failures. In the coronary heart disease, the protective effects of flavonoids such as antioxidant, antithrombotic, anti-ischemic, and vasorelaxant and flavonoids reduce the risk of coronary heart disorders through three mechanisms: (a) improving coronary vasodilatation, (b) reducing the ability of platelets in the blood to clot, and (c) inhibiting low-density lipoproteins from oxidizing.

Honey a Neurological Diseases

There is important scientific literature for the illustration of nutraceutical agents as novel neuro protective therapies, and honey is one such promising nutraceutical antioxidant. Honey exerts anxiolytic, antide pressant, anticonvulsant and antinociceptive effects and ameliorates the oxidative content of the central nervous system. Several studies on honey propose that honey polyphenols have non tropic and neuroprotective properties. Polyphenol ingredients of honey quench biological ROS that lead to neurotoxicity, aging, and the pathological deposition of misfolded proteins, including amyloid beta. Polyphenol ingredients of honey counter oxidative stress through excitotoxins, including quinolinic acid and kainic acid and neurotoxins, including 5-S-cysteinyl-dopamine and 1-methyl – 4 – phenyl-1,2,3,6-tetrahydropyridine.

Place of Honey in Modern Medicine Antimicrobial Properties of Honey

In addition to important role of natural honey in the traditional medicine, during the past few decades, it was subjected to laboratory and clinical investigations. Antibacterial activity of honey is one of the most important findings that was first recognized in 1892;

Pathogens Found Sensitive to Honey

Honey has been reported to have an inhibitory effect to around 60 species of bacteria including aerobes and anaerobes, gram-positives and gram-negatives (Y.Imaz. H. 1999).[7] Pathogens that are found to be sensitive to anti-infective properties of honey are manifold (40). Various results are in favor of its activity against Bacillus anthracis, Corynebacterium diptheriae, Haemophilus influenza, Klebsiella pneumonia, Listeria monocytogenes, Mycobacterium tuberculosis, Pasteurella multicoda, Yersinia enterocolitica, Proteus species, Pseudomonas aeruginosa, Acinetobacter spp, salmonella diarrhea, Sal. Typhi, Serratia marcescen, Shigella dysentery, Strep. mutans,Strep. pneumoniae, Strep.pyogenes and Vibrio cholera (heitkamp. K, 1986)[6] (Isch ayek. JI. 2006) 13 Tonas Barberam (2001).[10] Previously, a small

number of case studies examining the antimicrobial activity of honey against methicillin resistant Staph. aureus (MRSA) organisms demonstrated that natural honey had an antimicrobial activity against the community-associated MRSA organisms in vitro condition (Jenkins .D, 2002)16 Jawad, F.H (1981).[18]

HONEY AND HEALTH: A REVIEW OF RECENT CLINICAL RESEARCH

Nutrition and Health Effects

Oral Health

There is much debate whether honey is harmful to teeth. Some reports show a cariogenic effect of honeyp (Bower W.H. 2005, Mohan, 2001)[50] (Mohlan, P.2001) 3 or much less cariogenic effect than sucrose.[107] Due to its antibacterial activity honey ingestion inhibits the growth of bacteria, causing caries[108, 109] and might induce a cario protective effect (Grobler.S. 1994).[54] It was shown that Manuka honey, a very potent antimicrobial honey, has a positive effect against dental plaque development and gingivitis[112] and can be used instead of refined sugar in the manufacture of candy.[109]

GASTROENTEROLOGY

The oligosaccharides panose was the most active oligosaccharides cause an increase of bifidobacteria and lactobacilli and exert the prebiotic effect in a synergistic mode of action [Shamala, TR, 2000].[59] According to an invitro study on five bifidobacteria strains honey has a growth promoting effect similar to that of fructose and glucose oligosaccharides [Haffejee I.E, 1986-87-85)].[60] Unifloral honeys of sour-wood, alfalfa and sage origin stimulated the growth of five human intestinal bifidobacteria. In another study honey increased both in vivo (small and large intestines of rats) and in vitro the building of Lactobacillus acidophilus and Lactobacillus plantarum, while sucrose had no effect [Ladas, SD, 1999].[61]

In clinical studies with infants and children honey shortens the duration of bacterial diarrhea and did not prolong the duration of non-bacterial diarrhea. In certain cases, consumption of relatively large amount of honey (50 to 100 g) can lead to a mild laxative effect in individuals with insufficient absorption of honey fructose [Sirnik.V.1978][63] Al-Waili. NS.2001.[63] Fructose alone is less readily absorbed in the intestinal tract than fructose together with glucose [Al-waili., N.S 2004].[20] The mild laxative properties of honey are used for the treatment of constipation in Eastern Europe. Supplementation of honey in concentrations of 2,4, 6 and 8 g/100g protein fed to rats, improved protein and lipid digestibility.

CARDIOVASCULAR HEALTH

Honey can contain nitric oxide (NO) metabolites which are known indicators for cardiovascular disease risk. Increased the levels of nitric oxides in honey might have a protecting function in cardiovascular diseases. Total nitrite concentration in different biological fluids from humans, including saliva, plasma, and urine was measured after ingestion of 80 g of honey. Salivary, plasma and urinary no metabolite concentrations showed a tendency to increase. Different honey types containing various concentrations of no metabolites, darker or fresh honeys containing more no metabolites than light or stored honey. After heating, no metabolites decreased in all honey types.

Infants

An experiment with honey and milk showed that infants were suffering less frequently from diarrhea, and their blood contained more haemoglobin compared to those on a diet based on sucrose sweetened milk. Honey fed infants had an improved calcium uptake, and lighter and thinner faces. However, there is a health concern for infants regarding the presence of clostridium (Cl.) botulinum in honey. Since the presence of this bacterium in natural foods is ubiquitous and honey is non-sterilized packaged food from natural origin the risk of a low contamination level cannot be excluded. Spores of this bacterium can survive in honey, but they cannot build toxin. Thus, in the stomach of infants younger than one year the bacteria spores from honey can survive and theoretically build the toxin, while children older than 12 months can ingest honey without any risk.

ATHLETIC PERFORMANCE

The psysiological action of gel and powered forms of honey as a carbohydrate source for athlete performance was studied recently under controlled conditions by Kreider and coworkers. Honey increased significantly the heart frequency and the blood glucose level during the performance or during resistance training. In another trial the effect of low and high GI carbohydrate gels and honey were tested on a 64 km cycling performance and

the effect of honey was slightly better than the one of glucose. According to the above studies honey is well tolerated and can be an effective carbohydrate source for athletic performance. Infarction effects in rat (Grabler,1994).[54] In a study, pretreatment of anaesthetized normal or stressed rats with natural honey (5 g/kg) for 1 hr prior to adrenaline injection (100 mcg/kg) could protect them from epinephrine induced vasomotor dysfunction and cardiac disorders and preserved the positive inotropic effect of adrenaline.

Allergy

Honey allergy seemed relatively uncommon; allergies reporter can involve reactions varying from cough too anaphylaxis [Fravenfelder, r.A 1921].[64] In this study it was reported that patients allergic to pollen are rarely allergic to honey, although there is one reported case of combined honey pollen allergy.[168] The incidence of honey allergy, reported in a group of 173 food allergy patients was 2.3%.[169] In this study the honey allergy is explained by the presence of components of bee origin.

CONCLUSION

Concluding Remarks

To date, researchers pay more attention to medicines with natural origin and believe that natural products may be efficient therapeutics in comparison with the synthetic drugs. One of the most important natural products is honey, which has been used for different medicinal purposes since ancient times.In addition to important role of honey in the traditional medicine, scientists also accept honey as a new effective medicine. Sufficient evidence exists recommending the use of honey in the management of disease conditions.

Evidence confirming the use of honey in all areas of clinical practice is needed. Studies revealed that the medicinal effect of honey may be due to of its antibacterial, anti-inflammatory, apoptotic and antioxidant properties. This review should provide practitioner with remarkable evidence supporting the use of honey in the medical field. Although some studies exist having tested the efficacy of honey in relation to medical purposes, more studies are needed to cover all medicinal aspects of honey.

Table 1: Honey nutrients(values compiled after different authors and recommended daily intake)

Ingredient	Amount in 100g	Recommended Daily Intake		
		1-4 years old	4-15 years old	After 15 years old
Energy Carbohydrates Proteins				
Facts	Kcal			
	kcal 300	1000-1100	1400-2700	2400-3100
	g 0.5	13-14	17-46	44-59
	g 0			
Minerals	**Mg**			
Sodium(Na)	1.6-17	300	410-550	550
Calcium(Ca)	3-31	600	700-1200	1000-1200
Potassium(K)	40-3500	1000	1400-1900	2000
Magnesium(Mg)	0.7-13	80	120-310	300-400
Phosphorus(P)	2-15	500	600-1250	700-1250
Zinc(Zn)	0.05-2	3	5-9.5	7-10
Copper(Cu)	0.02-0.6	0.5-1	0.5-1	0.5-1
Iron(Fe)	0.03-4	8	8-15	10-15
Manganese(Mn)	0.02-2	1-1.5	1.5-5	2-5
Chromium(Cr)	0.01-0.3	0.02-0.06	0.02-0.1	0.03-1.5
Selenium(Se)	0.002-0.01	0.001-0.004	0.001-0.006	0.003-0.007
Vitamins	**Mg**			
Phyllochinon(K)	ca.0.025	15	20-50	60-70
Thiamin(B1)	0.00-0.01	0.6	0.8-1.4	1-1.3

Riboflavin(B2)	0.01-0.02	0.7	0.9-1.6	1.2-1.5
Pyridoxin(B6)	0.01-0.32	0.4	0.5-1.4	1.2-1.6
Niacin2	0.10-0.20	7	10-18	13-17
Panthothenic acid	0.02-0.11	4	4-6	6
Ascorbic acid(C)	2.2-2.5	60	70-100	100

*-only major components considered after the German Nutrition Society
Niacin equivalents: 1 mg nicotinamide= 1 mgniacin=60 mg tryptophan (=niacin – precursor).

Table 2: List of bacteria that were found to be sensitive to honey

S. No	Pathogen	Infection caused
1.	Bacillus anthracis	Anthrax
2.	Corynebacterium diphtheria	Diphtheria
3.	Escherichia coli	Diarrhea, septicaemia, urinary infections, wound infections
4.	Haemophilus influenza	Ear infections, meningitis, respiratory infections, sinusitis
5.	Klebsiella pneumonia	Pneumonia
6.	Mycobacterium tuberculosis	Tuberculosis
7.	Proteus sp.	Septicaemia, urinary infections
8.	Pseudomonas aeruginosa	Urinary infections, wound infections
9.	Salmonella sp.	Diarrhoea
10.	Salmonella cholera-suis	Septicaemia
11.	Salmonella typhi	Typhoid
12.	Salmonella typhimurium	Wound infections
13.	Serrate marcescens	Septicaemia, wound infections
14.	Shigella sp.	Dysentery
15.	Staphylococcus aureus	Abcesses., boils, carbuncles, impetigo, wound infections
16.	Streptococcus faecalis	Urinary infections
17.	Streptococcus mutans	Dental carries
18.	Streptococcus pneumonia	Ear infections, meningitis, pneumonia, sinusitis
19.	Streptococcus pyogenes	Ear infections, impetigo, puerperal fever, rheumatic fever, scarlet fever, sore throat, wound infections
20.	Vibrio choleriae	Cholera
21.	Actinomyces pyogenes, Klebsiella pneumonia, Nocardia asteroids, Staphylococcus aureus, Streptococcus agal., dysgal., uber	Mastitis
22.	Epidermophyton floccosum, Microsporum canis,M.. gypseum, Trichophyton rubrum, T.tonsurans, T.mentagrophytes var.?	Tinea
23.	Diff. Escherichia coli, Salmonella, Shigella, Vibrio, Helicobacter pylori	Peptic ulcer

ACKNOWLEDGEMENT

The authors (PSR, R.P) wishes to acknowledge, Dr. P. S. Rathipriya, MBBS, Bangalore, For given valuable clinical advice and full support for completion of this research.

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