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Critical Review

Honey, a Gift from Nature to Health and Beauty: A Review

Hazrina Hadi*, Syarifah Shakira Syed Omar, Ammar Ihsan Awadh
Faculty of Pharmacy, International Islamic University Malaysia, Bandar Indera Mahkota, 25200 Kuantan, Pahang, Malaysia

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*Corresponding author.
Tel.: +6095716400
Fax: +6095716775
E-mail: hazrina@iium.edu.my

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ABSTRACT

Benefits of honey are contributed by the composition of its elements such as glucose, fructose, glucose oxidase, vitamins and phenolic compounds. For health, honey can be used to treat wounds due to the antibacterial activity conferred by the hydrogen peroxide produced by glucose oxidase in honey. Anti-inflammatory, anti-oxidant, deodorizing and tissue regeneration activities in honey also help in the wound healing process. It can also be an alternative sweetener for diabetic patients to ensure compliance to a healthy diet. Moreover, honey exerts several effects such as lowering low density lipids and increasing high density lipids, thus reducing risk of atherosclerosis. In terms of beauty, honey can be used on skin and hair. It moisturizes skin through its natural humectant properties contributed by high contents of fructose and glucose. Honey treats acne on the skin due to its antibacterial activity, anti-inflammatory action and tissue repair. The hair can benefit from honey in such a way that the hair has abundance, and becomes easier to comb. However, there have not been as many studies regarding the use of honey in skin in comparison to its use for health. Therefore, future studies on honey could research its use, action and benefits in both cosmetics and dermatology.

INTRODUCTION

Honey was known and used by human since a very long time ago. A discovery of a rock painting, the Man of Bicorp, was made in 1921 in Cueva de la Arana (Spider Cave) in Valencia, Spain. The painting is believed to date back around 15000 years which would be near the end of the Palaeolithic era. This painting displays a human figure near a beehive, and in the picture he is depicted picking up honeycombs. Hence, the picture of the Man of Bicorp proves that pre-historic man was using honey as a part of his diet although he faced challenges in gathering honey. However, we do not know if there was any other use of honey in terms of medicinal purposes at that time (Hajar 2002).

In addition to that, archaeologists also found a painting in a Neolithic shrine at Catal Huyuk in Anatolia which dated far back to around 700 BC. The painting had flower-like patterns, parallel wavy lines and winged insects. These patterns were then interpreted as the life cycle of the bee in a honeycomb (Crane 2013). Uses of honey during that era there were as a natural sweetener, to treat wounds (Ajibola et al. 2012), to use its wax for painting (Petukhova and Bonadies 1993) embalming bodies, binders for ships and boats (Hajar 2002) and cosmetics (Burlando and Cornara 2013).

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A few thousand years back, honey was mentioned frequently in Greek and Egyptian mythology. In Greek mythology, it is said that Zeus, who is one of the mightiest gods, was hidden from his evil father and was raised on milk and honey to the point that he became so strong and tough that he took the throne from his father (Cook 1895). Honey was also believed to be the food of gods and goddesses that contributed to their immortal life (Lavazaro 2009). On the other hand, in Egyptian mythology, honey was used as an offering to the gods to show devotion and worship. Jars of honey were found in the tombs of Pharaohs as it was also believed to be sustenance for the next life (Hajar 2002).

Formation of Honey

Honey is made by bees in a beehive. Each bee hive consists of one queen bee, 500 to 1000 drones and 30000 to 60000 workers. The queen is the only female that is sexually developed in the hive (Townsend and Lucas, 1940; Mullen 2015). The main role of the queen is to lay eggs after mating with the drones. Drones are sexually developed males that lack stingers and their sole purpose in the bee hive is to mate with the queen. During mating, the queen receives millions of sperm that may last her entire lifetime (Page and Metcalf 1982). The normal lifespan of a queen is about 3–4 years. On the other hand, the drones die not long after mating (Ediriweera and Premarathna 2012).

Finally, the worker bees are the sexually underdeveloped females which do all the jobs in the hive such as collecting nectar, caring for larvae, cleaning the nursery and making wax comb. They collect nectar from flowers, and later, in the hive, they will ingest and regurgitate the nectar many times until it is partially digested and reaches a certain level of quality (Mullen 2015). Next, the nectar will be stored in the honeycomb and left unsealed for drying as the raw honey is composed of a high amount of water. The drying process is done by the worker bees that fan their wings to assist evaporation of water. Afterwards, the honeycomb is sealed with wax in order to preserve the honey (Ediriweera and Premarathna 2012).

This honey has a long shelf-life and will not ferment if properly sealed (Ediriweera and Premarathna 2012). Honey consists of several enzymes from the hypopharyngeal glands of the worker bees such as invertase, amylase and glucose oxidase (Weirich et al. 2002). Glucose oxidase oxidizes glucose to gluconic acid and hydrogen peroxide. Hydrogen peroxide is the component of honey that stabilizes ripening honey from spoilage (Jeffrey and Echazarreta 1996).

Composition of Honey

The constituents of honey can vary depending upon the source of the nectar. However, the major constituents remain constant. These constituents are listed in Table 1 (Jeffrey and Echazarreta 1996).

Table 1. *The average composition of honey. Data was collected from 490 samples of US honey (Jeffrey and Echazarreta, 1996)*

Component Average	%
Moisture	17.2
Fructose	38.19
Glucose	31.28
Sucrose	1.31
Disaccharides, calculated as maltose	7.31
Higher sugars	1.50
Free acid as gluconic	0.43
Lactone as gluconolactone	0.14
Total acid as gluconic	0.57
Ash	0.17
Nitrogen	0.04

Carbohydrate is the predominant solid (approximately 95% of total solid content) in honey. The main carbohydrates present in honey are glucose and fructose (Busserolles et al. 2002). In adition to glucose and fructose several other sugar have been identified including isomaltose, nigerose, turanose, maltulose; kojibiose; alpha beta-trehalose, gentiobiose, laminaribiose, maltotriose, 1-kestose, panose, isomaltosyl glucose, erlose, isomaltosyltriose, theanderose, centose, isopanose, isomaltosyltetraose and isomaltosylpentaose (Jeffrey and Echazarreta 1996). Therefore, honey is actually a complex mixture of sugar which is in an immediately digestible form (Ferreira et al. 2009)

Gluconic acid is the product of the enzyme glucose oxidase on glucose (Molan 1992). There are also several other enzymes present in honey which can be divided into two categories, namely enzymes originating from the hypopharyngeal gland of worker honeybees and enzymes originating from

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plants. Invertase, glucose oxidase, amylase, catalase and acid phosphatase are enzymes from worker honeybees' hypopharyngeal gland. The enzymes from plants include catalase and acid phosphatase and a small amount of amylase (Jeffrey and Echazarreta 1996). The enzyme glucose oxidase is of particular interest as it produces hydrogen peroxide which is a chemical that can exert antibacterial activity (Dustmann, 1979).

Furthermore, there are wide variety of vitamins present in honey such as vitamin B6, thiamin, cyanocobalamin, folic acid, vitamin C, riboflavin, pantothenic acid, ascorbic acid and many more (Ciulu et al. 2011). Not only that, there are also several essential mineral contents namely calcium, copper, iron, magnesium, manganese, phosphorus, potassium, sodium and zinc as well as several different amino acids (Mullen and Thomson 2015) such as proline, phenyalanine and aspartic acid (Busserolle et al. 2002; Mullen and Thomson 2015).

Honey also contains some components which have antioxidant properties (Jeffrey and Echazarreta 1996; Gheldof et al. 2002) namely chrysin, pinobanksin, vitamin C, catalase and pinocembrin (Mullen and Thomson 2015). There is a linear relationship between the level of phenolic acid and antioxidant activity. P-coumaric acid was found to be the most dominant phenolic acid in honey thus having the highest antioxidant activity (Socha et al. 2011). The function of antioxidant properties is to slow down the oxidative damage of the cells and tissue in our body.

Types of Honey

There are not only different species of bees, but there also different types of honey. However, each different type of honey depends on the floral source from which the bees collect the nectar (Burlando and Cornara 2013; Singh et al. 2012). Different types of honey include acacia, manuka and buckwheat (Ranzato et al. 2012). The most popular and widely used honeys are acacia and manuka honey. Acacia honey originates from black locust (*Robinia pseudoacacia L.*), and it has received much attention in the cosmetic field. On the other hand, manuka honey is more popular from a dermatological aspect, especially in wound healing, as it has significant antibacterial activity (Molan 2002). The differences between these honeys are not only composition-wise but can also been seen through micrographs as they have different shapes when observe under microscopes as well (Burlando and Cornara 2013).

HONEY FOR HEALTH AND BEAUTY

Honey for Health

Wound Dressing

A wound is an injury to living tissue caused by a cut, blow or other impact, typically one in which the skin is cut or broken. When there are bacteria in the wound, the wound can become infected. The extent of harmful effect that can occur depends on the patient's immune system, number of bacteria introduced and also type of bacteria introduced (Abbas et al. 2015). There are several stages of infection process which starts with contamination (Baranoski and Ayello 2008). The next stage is colonization, which refers to the multiplication of the bacteria but without any tissue damage. Finally this leads to infection, where the bacteria multiply, wound tissues are damaged, healing is delayed and the patient may acquire systemic infections (Abbas et al. 2015). Various research studies have stated that honey can be used in wound management. This is due to certain properties that promote wound healing and also reduce bacterial infection (Molan 1999).

One of the most important properties that make honey a good wound healing therapy is its antibacterial property (Molan 1992). The antibacterial property of honey comes from hydrogen peroxide which is produced from the enzyme glucose oxidase. Glucose oxidase induces the production of hydrogen peroxide in the honey (Ciulu et al. 2011). Hydrogen peroxide will enhance the production of cytokines for the inflammatory response to kill the bacteria. The enzyme glucose oxidase is added to the nectar by honeybees, and the antibacterial activity varies depending on the floral source (Molan 1992; Molan 1999; Leigh 2008). As hydrogen peroxide is a reactive oxygen species, its antibacterial action occurs through damaging the cell structure of the bacteria (Brudzynski 2006). The damaging action highly depends on the

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concentration of hydrogen peroxide in the honey (Brudzynski 2006; Finnegan et al. 2010).

Hydrogen peroxide alone is found not to be effective in treating wounds. This is because it is only effective at high concentration, but the wound healing properties is limited by its own protein and tissue damaging effect at high concentration (Mohamed et al. 2012). When honey is diluted, the enzyme producing hydrogen peroxide becomes active. This gives honey its slow release properties of hydrogen peroxide (Brudzynski 2006). Thus, honey is able to continually produce hydrogen peroxide at a steady rate (Molan 1999).

Furthermore, another important property of honey is as an antioxidant. The antioxidant property of honey comes from phenolic compounds, carotenoid-like compounds and amino acids (Socha et al. 2011). This property is useful in neutralizing free radicals produced by the action of hydrogen peroxide thus protecting tissue from damage (Socha et al. 2011; Molan 1999). Moreover, honey also possesses an anti-inflammatory action which is exerted by the antioxidant property (Molan 1999). Free radicals are involved in inflammation; therefore, when the free radicals are reduced, the inflammatory cells are also reduced, hence soothing the pain (Weissenstein et al. 2014).

Deodorizing action is another ability of honey in wound management (Leigh 2008). When infecting bacteria metabolize amino acids from protein and necrotic tissue, ammonia, amines and sulphur compounds are produced (Mohamed et al. 2012). These compounds are the cause of odour. The odour is removed by honey due to its high content of glucose, which can be metabolized by the infecting bacteria (Molan 1999). Metabolized glucose will produce lactic acid instead of the compounds that gives out malodour. Not only that, honey is a viscous fluid that has high osmolarity (Molan 1992). Due to this fact, it is able to bond with the water molecules, hence reducing the water available for bacterial growth (Weissenstein et al. 2014). In other words, honey's high osmolarity exerts bacteriostatic action as it inhibits the growth of bacteria.

Many studies have also stated that honey can stimulate tissue growth (Molan 1999; Leigh 2008; Weissenstein et al. 2014). There are a few theories on how honey can stimulate tissue growth or epithelialization. Firstly, there is the presence of hydrogen peroxide at low concentration which can stimulate fibroblast formation (Mohamed et al. 2012). Secondly, there is the effect of honey's high osmolarity (Molan 1992). It can draw lymph fluid (from the wound), which is dissolved with nutrients, and can help tissue regeneration (Molan 1999). Morever, honey can regenerate tissue due to its own contents which include different types of essential nutrients (Weissenstein et al. 2014). Another theory is that acidification of the wound may enhance healing (Mohamed et al. 2012) and stimulate tissue growth (Leigh 2008). It is known that honey has a pH of 3 to 4 which is acidic (Molan 1999).

Honey able to debride a wound at a fast rate and replace the sluff with granulation tissue (Anderson et al. 1995). Throughout the course of healing, granulation tissue which consists of connective tissue and small blood vessels forms on the surface of the wound. A few experiments have shown that with the use of honey on wounds, healthy granulation tissue and epithelization were present (Leigh 2008; Bahrami et al. 2009; Mohamed et al. 2012). It is suggested that this situation occurs due to hydrogen peroxide or the acidity of honey which can promote angiogenesis (Mohamed et al. 2012).

Another theory suggested as to why honey can help in tissue repair concerns the composition of honey itself which consists of several nutrients and vitamins which may help stimulate growth of new tissue (Mohamed et al. 2012). However, honey has some cytotoxicity effects as well, as it induces the expression of cytokines and matrix metalloproteinase 9 which degrades collagen. Fortunately, the level of this cytotoxicity is extremely low (Ranzato et al. 2012).

Honey for Treatment of Acne

Due to the properties of honey as antibacterial, antioxidant and tissue growth promoter, it has been found that honey also can be used to treat acne. Acne occurs due to excess production of sebum which later on gets infected with *Propionibacterium acnes*, thus leading to the inflammatory stage (Anderson et al. 1995; Sabry 2009). Honey can be an

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alternative treatment for acne as it has several properties that can fight the root causes of acne.

The most prominent property of all is the antibacterial property of honey (Molan 1992; Jeffrey 1996; Molan 1999). There are three main factors that contribute to the antibacterial property which are osmotic effect, acidity and hydrogen peroxide (Burlando and Cornara 2013).

Honey is a viscous saturated liquid that has very low water content (Weissenstein et al. 2014). That being so, honey has an osmotic effect which makes it able to interact with water strongly, leaving insufficient water for the microorganism, which in this case is *Propionibacterium acnes* to survive (Molan 1992). There was a study done that suggested an alternative treatment for acne by acting on the environment of the bacteria itself. This study hypothesized that the limiting nutrient for *Propionibacterium acnes* in the pilosebaceous gland is water (Holt and Cole 2014). Hence, in order to prevent microbial growth, the water available to microorganisms should be reduced.

Furthermore, the effect of honey's low pH as antibacterial has been mentioned in a few studies, although there has been no clear proof that it does affect microbial growth (Molan 1999). Another contributing factor for the antibacterial property of honey is the release of hydrogen peroxide by the enzyme glucose oxidase (Brudzynski 2006) as previously described.

As well as being able to deal with acne through its antibacterial property, honey also has an anti-inflammatory action that may help as well (Ajibola et al. 2012). Inflammation in the acne may lead to serous exudates which would be conducive for bacteria to colonize (Anderson et al. 1995). When this happens, the infection would be worse. Honey has several antioxidant contents that can act as scavengers of reactive oxygen species (ROS) (Molan 1999). The reduction of ROS will reduce inflammation because ROS are one of the components of inflammation. According to Gheldof et al., a darker colour of honey indicates a higher content of phenolic compounds which means that it has higher radical scavenging activity, hence higher antioxidant activity as well (Gheldof et al. 2002).

Finally, honey has been said to be involved in tissue repair. A dead or damaged tissue is removed when a wound heals and is later replaced with a new layer of skin with the help of honey (Singh 2012). The action of honey as tissue repair promoter is as described previously in the previous subheading; wound dressing.

Role of Honey in Diabetes

Diabetes is divided into two main types which are Type 1 and Type 2 diabetes. Type 1 diabetes accounts for about 5%–10% of diabetes. The cause of type 1 diabetes is cellular-mediated autoimmune destruction of the β-cells of the pancreas. On the other hand, Type 2 diabetes can be due to a variety of causes which in the end will lead to insulin resistance or insulin deficiency. The prevalence of Type 2 diabetes is 90%–95% (Harvey and Ferrier 2011a). Diabetes usually managed by changes to a low glucose diet. However, there should be an alternative to sugar as a sweetener to ensure patients' compliance (Jeffrey 1996). Therefore, honey is one of the proposed alternative sweeteners for diabetes patients.

There have been many discussions on whether honey is beneficial or not for diabetes patients. Several studies have proved that honey can be beneficial to diabetes patients. The first reason is highly dependent on the composition of honey itself. Honey's major component is carbohydrates, mainly glucose and fructose (Busserolles et al. 2002). Fructose is slowly absorbed from the gastrointestinal tract compared to glucose which makes its metabolism, insulin independent (Donadieu, 1982). Blood sugar level also rises minimally after fructose intake as it is taken up by the liver rapidly (Bahrami et al. 2009).

A few studies have shown that honey has a low glycaemic index (GI) and peak incremental index (PII) (Deibert et al. 2010; Abdulrhman et al. 2011). Both GI and PII are the measures on the effects of food on the blood glucose level. In comparison to sucrose and glucose, honey has a lower GI and PII in both healthy and diabetic subjects (Abdulrhman et al. 2011). However, the GI and PII differ between different types of honey based on different floral sources. The higher the fructose–glucose ratio of a type of honey, the lower is its GI (Deibert et al.

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2010). Low GI diet can improve overall glycaemic control and also reduce postprandial hyperglycaemia (Abdulrhman et al. 2011).

Honey increases C-peptide levels in non-diabetic patients, yet it does not increase significantly in diabetic patients (Abdulrhman et al. 2011). Honey may have a direct stimulatory effect on healthy β-cells, but its effect on defective β-cells is still unsure. Further study needs to be done to understand the effect of honey consumption on C-peptide levels of diabetic patients. C-peptide is a marker for insulin secretion as it is co-secreted with insulin as a by-product of proinsulin conversion into insulin (Harvey and Ferrier 2011b).

However, some studies state that most of the fructose will be converted into glucose (Donadieu 1982), thus increasing the rate of absorption and proceeding to an insulin dependent metabolism. Other than that, another detrimental effect mentioned is that fructose is one of the components involved in the formation of atheroma (Donadieu 1982). Hence, intake of honey will enhance the formation of atheroma and lead to further vascular complications (Cannizzo et al. 2013). Although, fructose intake may be associated with speeding up the formation of atheroma, this is only true when the intake of fructose is high. However, this is not the case with diabetic patients. Even though honey is an alternative sweetener, the intake allowed will be limited as honey also contains glucose. Conclusively, there will be no problem of high fructose intake with honey consumption in diabetes patients.

Other than being an alternative sweetener, honey has some positive effects which may even possibly allow honey to act as a supplement for diabetic patients. A randomized clinical trial was done in order to assess the effects of natural honey consumption in diabetic patients. The results of the study showed that there was a decrease in body weight, total cholesterol, low density lipoprotein (LDL) and triglyceride, and also an increase of high density lipoprotein (HDL) (Bahrami et al. 2009). LDL is bad cholesterol which causes the formation of plaque on the walls of arteries which can clog the arteries and reduce their elasticity. In contrast, HDL is good cholesterol which assists in the removal of LDL (Romain et al. 2014). Consequently, honey is helpful in preventing the formation of plaque in the blood vessels, thus preventing complications such as atherosclerosis in diabetic patients.

The antioxidant agent in honey is speculated to be the compound that is responsible for both weight and blood cholesterol reduction based on past studies that discovered the blood cholesterol lowering effect of antioxidants (Hemmati et al. 2015). Nonetheless, a negative point discovered is that honey intake increases the level of haemoglobin A1c which is a measure of blood sugar levels over a long period of time (Bahrami et al. 2009). Regardless of the increase in haemoglobin A1c, honey intake is still beneficial to diabetic patients, but it should be taken cautiously.

Honey for Beauty

Skin

Honey as Moisturizer

Skin is the largest organ and it is the outermost layer of the human body. For that reason, it requires a great amount of care to prevent diseases such as infections, dermatitis or even dehydration. Many research studies have found that honey has an abundance of uses in protecting and also healing the skin. This contribution is mainly due to the composition of honey which consists of many minerals, vitamins, phytocompounds and enzymes (Burlando and Cornara 2013).

Moisturizers are topical products of various formulations applied to the skin in order to retain moisture (Burlando and Cornara 2013). They are used to prevent and treat dry skin, and, on top of that, they can also keep the skin supple and enhance the natural barrier function of the skin (Eady et al. 2013). Several different formulations of moisturizers include barrier cream, emollients, lotions and ointment. The use of a moisturizer largely depends on the age, skin type and pre-existing conditions of the skin such as acne.

The common ingredients of a moisturizer include emollients, humectants and other ingredients. Past research found out that honey can be used as a moisturizer for the skin. The ability of honey to act as a moisturizer comes from its natural humectant

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properties (Eady et al. 2013). Though, the exact mechanism is unknown, it is believed that the humectant property is contributed by the high content of glucose and fructose in honey. Both fructose and glucose can form hydrogen bridges with water, retaining the moisture in the horny skin layer thus providing a hydrating effect to the skin (Burlando and Cornara 2013).

The hydrating effect of honey not only comes from the high content of fructose and glucose, but it may also be derived from the various amino acids (predominantly proline, but also arginine, alanine, glutamic acid, aspartic acid, lysine, glycine and leucine) and organic acid (largely gluconic acid and, to a certain extent, lactic, citric, succinic, formic, malic, acetic, maleic and oxalic acids) that can augment the effect of glucose and fructose in retaining moisture in the horny skin layer (Burlando and Cornara 2013). Unfortunately, there has only been a minute amount of study to really assess the moisturizing effects of honey on the skin. Therefore, for future research, testing and assessing how honey gives this hydrating effect is highly suggested, to understand its advantage and disadvantage when used as a moisturizer.

Hair

Healthy hair is characterized as being pigmented, soft, smooth, glossy and flexible yet strong enough to be able to withstand shearing forces such as friction (Greenwood and Handsaker 2012). This structural and physical characteristic of hair depends on its structure which consists of cuticles and cortex (Sinclair 2007). The strength of hair depends on the cortex while the gloss depends on the cuticles (Robbins and Crawford 1991).

The cortex is surrounded by a multilayer of cuticles which regulates the penetration of water in and out of the cortex (Wolfram and Lindemann 1971; Madnani and Khan 2013). There are several layers of cuticles from the outermost layer, which are the epicuticle, the A layer, the exocuticle/B layer and the endocuticle (Robbins and Crawford 1991). The epicuticle layer is the first line of defence against water. Directly below it is the A layer which is high in cysteine. The thiol group of cysteine will undergo oxidation and form a disulfide bridge which is responsible for the cuticle strength and rigidity. The next two layers have less cysteine making them much softer especially the endocuticle layer. The endocuticle layer also consists of a protein which is responsible for absorbing water hence allowing change in the physical property of the hair. Cuticles that are intact and well organized are a very important indication of good and healthy hair (Madnani and Khan 2013).

The cortex which lies beneath the cuticles has a stronger disulfide bridge than the cuticle thus providing the hair with its ultimate shape (Paus and Cotsarelis 1999). Not only that, hydrogen bonds and van der Waal bonds are also present in this layer for the purpose of wetting. Most importantly this layer has melanosomes which are gravely important in determining the individual hair colour. The hair colour is based on the presence of eumelanin (red) or pheomelanin (black/brown). The core of the hair fibre which is located immediately below the cortex is the medulla. This layer is unique as it is only present in thick dark hair and not in grey aging hair (Chikvaidze et al. 2014).

Hair damage can easily occur due to lack of care, environmental factors such as excessive UV exposure, excessive wetting and also chemical procedures done to the hair (Marsh et al. 2015). One of the ways to protect the hair is by washing the hair. Studies done have proven that shampoos and conditioners containing honey give a beneficial effect in helping keep the hair in a good and healthy condition (Paus and Cotsarelis 1999). One of the benefits is that honey penetrates deep into the hair shaft and mends the hair's flexibility and elasticity (Burlando and Cornara 2013). Research was done to compare hair washing using two products, one of which contained honey. This study concluded that honey is able to confer abundance to the hair, maintains the wave and in addition to that lubricates the hair for ease of combing (Borcllorst 1978).

CONCLUSIONS

In conclusion, the various uses of honey have been proven to date back as far as 700 BC. Research has discovered that honey has been used to promote health in men, specifically in treating wounds and also as a supplement or alternative sweetener for diabetic patients. Beauty-wise, honey has been

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found to have good effects on the skin and hair. Honey is a possible treatment for acne, and it can act as a moisturizer as well. Honey also has anti-inflammatory effects contributed by antioxidants, and it can aid in tissue repair and reduce scarring. Moreover, honey's high content of fructose and glucose is proven to give a hydrating effect to the skin besides the various amino acids present. This hydrating effect helps to moisturize the skin and keep it supple. In terms of hair treatment, honey confers abundance to the hair and also makes the hair easier to comb. Though there have been a lot of discoveries regarding the use of honey, there are still other avenues on the use of honey that could be considered in future studies. Not only that, further studies on established uses of honey should be done in order to prove and compare the findings with recent ones. Specifically, the exact effect of how honey confers its moisturizing effect has not been studied deeply. The action of honey in hair that confers abundance and easy combing is also something that has not been mentioned in present studies. Hopefully, future studies could study the action and use of honey even further especially in the fields of cosmetics and dermatology.

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