Influence of intravenous Egyptian fennel honey infusion on the antioxidant activities and some haemo-indices in healthy goats

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Abstract
As an apitherapeutic use of honey has been reborn into modern medicine, the concept of its I/V administration must be fully studied. The objective of the work was to evaluate whether the intravenous (I/V) honey infusion in healthy goats affects the levels of antioxidants, free radicals scavenging and haemo-indices. Eight apparently healthy female goats were rapidly intravenously infused (70-80 drops/min.) with fennel honey solution 20% in sterile normal saline day by day for three successive times. By the second dose, the infusion was guarded by antihistaminic administration. The antioxidants glutathion peroxidase (GPX), superoxide dismutase (SOD) and ascorbic acid, free radical metabolites through malonaldehyde (MDA) production and some haemo-indices (total leucocytic count (TWBCs), differential leucocytic count and serum globulins) were determined every week up to four weeks. I/V honey infusion increased significantly (P<0.05) GPX, SOD, serum globulins, TWBCs count, lymphocytes and monocytes percentages but none significantly increased ascorbic acid levels. It was concluded that intravenous fennel honey infusion in goats would: a) Increase the activity of antioxidants GPX and SOD. b) Acts as scavenger free radicals by decreasing MDA levels. c) Improves haemo-indices by the increase of TWBCs count, lymphocytes and monocytes percentages and serum globulins level. All these desired obtained results were achieved by the fourth week post infusion.

Keywords: fennel honey, antioxidants, intravenous infusion, haemo-indices

Introduction
It was mentioned in the Holy Quran that bees produce drink of varying colours that cure illness (Surat Al-Nahl, Aya 69). Honey in ancient medicine proved its potency and its therapeutic use is widely documented since it is adopted as antimicrobial, anti-inflammatory, antioxidant and promotes wound healing by different application routes; topical application,2,3 oral administration,4 intravenous,4,5 intramammary,4,5 intrauterine infusion11,17 as well as intrapulmonary inhalation.7

Among different unifloral honey types, manuka honey,13,14 from New Zealand has the strongest antioxidant activity. Tualang,15 nenas16 and gelam17 honey from Malaysian, sundarban14 honey from Bangladesh, acacia,16 sederg15,26 honeys from Saudi Arabia, jelly bush, tea tree, super manuka and jarrah honeys21 from Australia, lychee flower8 honey from China and multifloral25 honey from Ethiopia, Egyptian cotton, eucalyptus, black seed,24 and coriander25 and Spanish citrus26 honeys proved to possess antioxidant activity with different potencies.

Material and methods
Animals
Eight apparently healthy female goats 4-5 months old weighing about 10-24kg body weight were examined for clinically health investigations and be chosen for this study. Animals were left for two weeks before the study under strict clinical observations in an isolated pen, fed on concentrated ration, rice straw and water ad libitum daily.

Honey
Fresh Egyptian fennel honey was used in the study. It was collected from an apiary in Assiut Governorate where a wide area of fennel was cultivated. Honey microscopically tested for floral pollen grains. Unprocessed honey (2g/Kg body weight for every infused animal) was diluted with sterile normal saline solution to achieve 20% honey solution then, it was filtered under complete aseptic conditions using sterilized filter papers to remove any debris, wax, or large particles for the I/V infusion.9

I/V honey infusion
Honey solution was infused through jugular vein 70-80 drops/min as rapid infusion1, once daily and repeated day by day for three successive times. Animals were observed and inspected closely for any abnormal clinical manifestations.

Blood sampling: Two blood samples were collected from each goat before the study; one was with anticoagulant for hematological study and the other without to obtain their own sera. Blood sampling was repeated post the first honey infusion at four times weekly intervals. Hematological study included determination of total leucocytic count (TWBCs), percentages of band cells, segmented neutrophils, lymphocytes, eosinophils, basophils and monocytes. Serum samples were assayed for total proteins and total albumin contents to obtain their own total serum globulins.

Antioxidant investigation
Determination of lipid peroxidation through MDA production was adopted using a colorimetric assay with the thiobarbituric acid reactive
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In the present study, by three successive intravenous fennel honey infusions in goats augmented its therapeutic effects by high antioxidant parameters - significantly increase of GPX (Figure 1) and SOD (Figure 2), while lowered MDA significantly (Figure 3) - by the 1st, the 2nd and the 3rd week post intravenous infusion respectively. Manuka honey inhibited MDA in gastric ulcerated rats.\(^\text{9}\) Egyptian multifloral honey\(^\text{3}\) increased both GPX and SOD and decreased MDA levels in rats. Similar these positive results were obtained in healthy tested models as with Malaysian honeys (neenas H. in healthy university student,\(^\text{14}\) gelam H. in young and aged rats\(^\text{15}\) or with taluang H. in normal male mice\(^\text{30}\)). Moreover, the increased GPX and SOD with the decreased MDA was obtained with Malaysian taluang honey in stressed oxidative smokers\(^\text{16}\) or female athletes\(^\text{17}\) and in animal induced stress oxidative ovariectomized\(^\text{18}\) or diabetic rats.\(^\text{19}\) Otherwise, Iranian multifloral honey\(^\text{20}\) ameliorated the increased MDA content and reduced the activity of SOD in stressed oxidative rats due to the inhibition of pro-inflammatory cytokines: TNF-\(\alpha\), IL-1\(\beta\), and IL-6 by the action of the polyphenols, flavonoids, and caffeic acid phenethyl ester.\(^\text{21}\) Flavonoids – polyphenolic compounds are a group of secondary metabolites naturally occurring in the plant kingdom, possess numerous pharmacological activities.\(^\text{22}\) Most of the antioxidant benefits of honey are associated with the presence of polyphenols since there is high correlation between honey’s biological activity and the polyphenolic content.\(^\text{23}\) Chrysin (3,7-dihydroxyflavone) is a dietary phytochemical abundantly present in many plant extracts, then in honey and propolis\(^\text{24}\) which evolved as promising pharmacological agents as it possesses potent anti-inflammatory\(^\text{25}\) and antioxidant properties\(^\text{26}\) with direct positive effect on GPX, SOD and MDA.\(^\text{27}\)

Figure 1 GPX.

Figure 2 SOD.
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Total serum globulins (Figure 4) increased significantly by the 1st and the 4th week respectively post intravenous infusion, while ascorbic acid (Figure 5) increased but not significantly. Daily ingestion of 20% solution from floral-undetected Nigerian honey or intraperitoneal of 10% Egyptian fennel honey solution increased serum globulin and ascorbic acid levels, while daily ingestion of acacia Pakistanish honey up to 50% did not alter the serum globulin level. Vitamin C raises intracellular glutathione levels and playing an important role in protein thiol group protection against oxidation, so honey vitamin C content will magnify its antioxidant effect as the profound antioxidant efficacy might be due to the synergistic action of the polyphenols such as flavonoids, and other compounds such as vitamin C.

The leucogram revealed that TWBCs elevated significantly by the 4th week post intravenous infusion (Figure 6), where the percentages of lymphocytes (Figure 7) and monocytes (Figure 8) increased significantly by the 3rd week. Ingestion of daily honey solution increased total WBCs, lymphocytes and monocytes. In the present study, intravenous honey infusion decreased segmented cells (Figure 9) significantly by the 3rd week, while increased both band (Figure 10) and eosinophil cells (Figure 11) but not significantly.

In the present work, the leucogram also revealed that TWBCs
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It was concluded that rapid I/V infusion of Egyptian fennel 20% honey solution in goats increased enzymatic antioxidants (GPX and SOD) and decreased the free radical metabolites (MDA). Moreover, it improved some heamo-indices; total leucocytic count, lymphocytes, monocytes percentages and total serum globulins. Although a risky factor of 25% anaphylactic shock was noticed, the obtained positive results are in need to further investigations to overcome this risky factor. Subsequently, I/V infusion of Egyptian fennel honey is a good antioxidative and free radicals scavenging apitherapy, rather than a haemo-improvement mediator.

Conclusion

Acknowledgements

None.

Conflict of interest

The authors declare that there are no conflicts of interest.

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