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ORIGINAL ARTICLE

The effect of banana peels supplemented diet on acute liver failure rats

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Abstract Peel of vegetables and fruits are of the most important part that helps in protecting the body from diseases, getting rid of the free radicals, as they contain vitamins and minerals which are antioxidant, in addition to phenols. Previous studies have proved the existence of vitamin C, E, and B6 in banana peels, especially vitamin C that can act as an antioxidant.

The present study was performed to examine the effect of fresh and dried banana peels consumption on liver function (albumin, GPT, GOT, LDH, GGT and ALP) and lipid profiles cholesterol, triglycerides, low-density lipoprotein (LDL), high-density lipoprotein (HDL) and very low-density lipoprotein (VLDL) on acute liver failure rats induced by carbon tetrachloride. The chemical constituents, vitamins, minerals and fiber were determined for the tested fresh and dried banana peels.

This work was carried out on 40 adult male white albino rats randomly classified into eight groups (each of 5 rats). The first group was fed on basal diet as a "negative control". The other seven groups were injected by carbon tetrachloride to induce liver failure. The second group fed on basal diet as acute liver failure rat's untreated "positive control", the third into five groups fed on basal diet containing 5%, 10% and 15% fresh banana peels while the six into eight groups fed on basal diet containing of 5%, 10% and 15% dried banana peels for a period of four consecutive weeks.

Results revealed that all acute liver failure groups administrated with different levels of fresh banana peels (5%, 10% and 15%) had significant decrease in liver function, total cholesterol, triglycerides, LDL-c and VLDL-c cholesterol comparing with the positive control group. On the other hand, significant increase in HDL-c was recorded in all acute liver failure groups administrated with dried banana peels 5% and 10% comparing with control positive group. It was suggested that, consumption of fresh and dried banana peels may modify the risk of acute liver failure patients.

Introduction

Liver is unique to the subphylum Vertebrata and varies little among the classes. It is the largest organ of the body, occupies

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a strategic position between the intestinal tract and the rest of the body. Liver plays a crucial role in maintaining metabolic homeostasis. Its functions include the processing of dietary amino acids, carbohydrates, lipids, and vitamins; phagocytosis of particulate materials in the portal circulation; synthesis of serum proteins; biotransformation of circulating metabolites and detoxification and excretion of endogenous waste products and pollutant xenobiotics into the bile (Crawford, 1999).

Acute liver failure (ALF) is a complex multisystemic illness that evolves after a catastrophic insult to the liver manifesting in the development of a coagulopathy and encephalopathy within a short period of time. ALF is a heterogenous condition incorporating a range of clinical syndromes, principally determined by the underlying etiology, the age of the patient, and the duration of time over which the disease evolves (Harry et al., 2002). There are a number of classifications of ALF in use but in the UK the terms such as hyperacute, acute, and subacute are used to define the onset of encephalopathy within 7 days, 8–28 days, and more than 28 days, respectively. The natural history of the condition is very variable within this range and survival rates without transplantation range from 10% to 90% for different cohorts. Integrated multidisciplinary protocols that use liver transplantation are now achieving considerably improved survival rates in the range from 40% to 90% depending on the underlying etiology (Grady et al., 2013).

ALF is common complication of viral hepatitis, occurring in 0.2–4% of cases depending on the underlying etiology (Grady, 2000). The risk is lowest with hepatitis A, but it increases with the age at time of exposure. Hepatitis B can be associated with ALF through a number of scenarios. The commonest are de novo infection and spontaneous surges in viral replication, while the incidence of the delta virus infection seems to be decreasing rapidly (Bernal, 2003). Vaccination should reduce the incidence of hepatitis A and B, while antiviral drugs should ameliorate replication of hepatitis B. Hepatitis C is rarely recognized as the sole cause of ALF. Hepatitis E is common in parts of Asia and Africa and the risk of developing ALF increases to over 20% in pregnant women, being particularly high during the third trimester (Strauss et al., 2001). Unusual causes of viral ALF include herpes simplex 1 and 2, herpesvirus-6, varicella zoster, Epstein–Barr virus, and cytomegalovirus. Seronegative hepatitis is the commonest presumed viral cause in some parts of the western world, although there is little evidence to implicate a viral infection. Middle aged women are most commonly affected and it occurs sporadically. The diagnosis is one of exclusion (Murphy et al., 2004).

Banana should be considered to be a good source of natural antioxidant for foods and functional food source against cancer and heart disease (Someya et al., 2002). Therefore, attention in recent times has been focused on the isolation, characterization and utilization of natural antioxidants, especially growing interest in polyphenols as potential disease preventing agents. As these compounds are predominantly found in most of fruit tissues, it would be worthwhile investigating the nature of polyphenols that are present in banana peel. Fruits and vegetables however, contain many different antioxidant and antimicrobial components. The majority of the antioxidant capacity of a fruit or vegetable may be from compounds such as other vitamin C, vitamin E or β-carotene. Bananas are one of the most popular fruits in the world and it well be known that fruits contain various antioxidants compounds such as gallocatechin and dopamine (Mokbel and Hashinaga, 2004). Since the banana fruits are widely available, they have been used as food without apparent toxic effect. The peel could be a potential source of antioxidant and antimicrobial activities. Ethyl acetate and water soluble fractions of green banana peel displayed high antimicrobial and antioxidant activities. Most of the compounds isolated from green peel, β-sitosterol, malic acid, 12-hydroxystearic acid and succinic acid, showed significant antibacterial activities and low antioxidant activities, while those compounds isolated from water soluble extracts, glycoside and monosaccharide components, displayed significant antioxidant and low antimicrobial activities (Matook and Fumio, 2005).

Banana peel represents about 40% of total weight of the fresh fruit (Anhwange et al., 2008). The total amount of phenolic compounds in banana peel has been ranged from 0.90 to 3.0 g/100 g dry weight and gallocatechin is identified at a concentration of 160 mg/100 g dry weight; Someya et al. (2002). Other phytochemicals such as anthocyanin, delphinidin, cyaniding; Seymour, and catecholamines have been identified (Kanazawa and Sakakibara, 2000) in ripe banana pulp and peel. Recent studies demonstrated that banana peel generally includes higher phenolic compounds than those of banana pulps; Kondo et al. (2005) and Sulaiman et al. (2011). Subagio et al. (1996) identified carotenoids such as β-carotene, α-carotene and different xanthophylls in the range of 300–400 μg lutein equivalents/100 g. of banana peels. Gonzalez-Montelongo et al. (2010) studied the extraction conditions that produce maximum antioxidant activity (Acetone: water (1:1), 25 °C, 120 min). Moreover, the number of extraction steps, temperature and time, have been reported as the most effective factors associated with antioxidant properties of banana peel, respectively. According to the study by Someya et al. (2002) total phenolics are more abundant in peel (907 mg/100 g dry wt.) than in pulp (232 mg/100 g dry wt.) in Musa cavendish.

Mohamed and Fatma (2011) showed that the extract of some fruits and vegetables peels (apple APME, banana BPME, red beet RBPME and potato PPME) especially methanol extract has a significant protective effect against acute hepatotoxicity induced by CCl4 in rats, which may be due to its free radical scavenging effect and its ability to increase antioxidant activity.

This study aimed to investigate the effect of fresh and dried banana peels consumption on liver function and lipid profiles.

Materials and methods

Materials

Source of samples

Banana (Musa Acuminate) was purchased from local market in Egypt.

Chemicals and drugs

2 ml (v/v) carbon tetrachloride/kg Shibate et al. (1999) all chemicals were obtained from El-Gomhoria Company for chemicals, Cairo, Egypt.