Evaluation of the nutritional value of emping melinjo in rats, with special reference to nitrogen digestibility and mineral absorption

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Abstrak

Emping melinjo adalah produk dari biji melinjo bagian dalam yang pembuatannya dilakukan dengan merebus, kemudian dipipihkan dan dikeringkan dibawah sinar matahari.
Hingga saat ini belum banyak dilakukan penelitian mengenai nilai gizi emping melinjo. Karena emping melinjo umum dikonsumsi masyarakat Indonesia bahkan sudah merupakan komoditi eksport, maka dipandang perlu untuk mengetahui sejauh mana keuntungan dan kerugian bahan makanan tersebut terhadap kesehatan.

Untuk mendapatkan jawaban dilakukan penelitian berupa percobaan eksperimental dengan menggunakan tikus putih. Penelitian terdiri dari 2 tahap yakni :

1. Penelitian pendahuluan untuk mengetahui mutu protein dengan menggunakan metode Net Protein Utilization (NPU) dan Protein Efficiency Ratio (PER).

2. Penelitian tentang daya cerna nitrogen dan apsorpsi mineral dengan memperhatikan problematik yang didapatkan pada penelitian tahap 1. Pada penelitian tahap pertama yang diperhatikan hanya segi kuantitas dari protein {10%), lemak (10%) dan energy 400 kal. dengan penambahan vitamin dan mineral tanpa perhitungan yang akurat.

Sebaliknya, pada penelitian tahap ke-2, semua zat-zat gizi dalam ransum diperhitungkan dengan cermat, sehingga bernilai gizi adekuat dalam anti mengandung zat-zat gizi lengkap dan dalam jumlah cukup sesuai kebutuhan tikus percobaan seperti yang dianjurkan oleh National Research Council of the U.S.A.

Pada penelitian tahap ke-2 kegiatan meliputi :

a. Pemberian ransum dengan komponen emping melinjo mentah dalam 4 konsentrasi (0 %, 10 %, 20 %, 40 %).

b. Pemberian ransum dengan komponen emping melinjo mentah dibandingkan dengan emping melinjo goreng dengan konsentrasi sama (40 %).

Kelompok kontrol (0 %) adalah kasein

pada a. kadar protein 15 % (N + 6.25), lemak 5 %, kalsium 0.5 % magnesium 0.04 % phosphor 0.52 %,

pada b. kadar protein 15 %, lemak 15 %, kalsium 0.4 % magnesium 0.04 % phosphor 0.52 % lama penelitian 14 hart dengan hasil aebagai berikut

Pada percobaan tahap - 1

I. kimiawai : - Protein t 10 %

- Komposisi asam amino menyerupai asam amino telur

- Tidak ada asam amino pembatas

Percobaan dengan tikus

- NPU rendah

- PER rendah

- Angka kematian tinggi

- Hepatotoksik

II. Kimiawi:

- Tidak dapat dideteksi adanya penghambat tripsin

- Tidak dapat dideteksi adanya hemaglutinin Percobaan dengan tikus ;

- Semua tikus tumbuh dengan subur sama dengan kontrol, secara umum absorpsi nitrogen, Ca, Mg, P, back, hanya pada kelompok emping melinjo (40 %) menunjukkan absorpsi P rendah. Namun retensi baik.

- Pemeriksaan mikroskopik pada organ-organ vital tidak ditemukan kelainan.

- Kadar kolesterol dan trigliserida plasma darah lebih rendah dibanding kelompok kontrol.

Kesimpulan

1. Emping melinjo tidak dapat digunakan sebagai sumber protein tunggal pada tikus percobaan.

2. Protein emping melinjo mengandung susunan asam amino yang lengkap sehingga memungkinkan tikus tumbuh baik, bila diberikan bersama protein lain yang bermutu baik seperti kasein di dalam ransum yang bernilai gizi adekuat.

3. Kalau emping melinjo digunakan sebagai komponen ransum yang bernilai gizi adekuat tidak dapat dideteksi adanya efek negatif seperti keracunan pangan.

4. Kalau emping melinjo digunakan sebagai komponen ransum yang bernilai gizi adekuat, tidak terlihat adanya efek merugikan tikus percobaan mengenai pertumbuhan, daya cerna nitrogen, absorpsi mineral dan tidak menyebabkan tanda-tanda kelainan pathologis jaringan organ-organ tertentu.

5. Emping melinjo kering dapat digunakan sebagai konponen ransum tikus yang bernilai gizi adekuat, sampai pada kadar 40 g per 100 g makanan.

6. Seandainya hasil dari penelitian emping melinjo pada tikus, dapat diekstrapolasikan kepada manusia, kerugian kesehatan tidak diantisipasi jikalau dikonsumsi dalam jumlah yang umum dilakukan.

Emping melinjo kering dapat menurunkan kadar kolesterol dan trigiliserida dalam plasma. Saran:

1. Penggunaan emping melinjo sebagai bahan makanan manusia masih perlu diteliti lebih lanjut, diantaranya sebagai hasil olah dengan cara merebus, menggoreng dan sangan.

2. Perlu diteliti lebih lanjut kemampuan emping melinjo menurunkan plasma cholesterol dan trigliseida yang dikaitkan dengan penelitian epidemiologis diantara konsumen emping melinjo dan mereka yang tidak mengkonsumsinya.

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Gnetum gnemon LINN., also called tulip tree, is found throughout the islands of the Indonesian archipelago. Locally, this tree is known as melinjo tree, and its young stems and leaves, young and ripe fruits are used in a traditional dish.

The seeds of the ripe fruits are eaten after roasting. The seeds may also be processed in household-food industries into flattened and dried flakes called "emping melinjo". Prior to consumption, emping melinjo is usually fried in coconut fat which renders it crispy with a specific bitter taste. Emping melinjo is also exported to Middle East countries and the Netherlands (Departemen Perindustrian, 1988).

The nutritional value of emping melinjo has not yet been studied in detail. A feeding trial using rats fed emping melinjo as the sole source of protein showed a low protein efficiency ratio when compared with skim milk (Oey, 1979). Budiarso and Sihombing (1989) reported that livers of rats fed diets containing melinjo seeds as major ingredient had perilobular necrosis.

These studies suggest that emping melinjo has low nutritional value and may even contain toxic substances. However, the diets used consisted of emping melinjo as sole source of protein supplemented with vitamin and mineral mixtures.

This is very different from the situation in Indonesians who consume emping melinjo as a snack, side dish or as a component of the rice menu. Thus, a study was performed with rats fed nutritionally adequate diets with

varying levels of emping melinjo, either in dried/unfried or dried/fried form. The nutritional value of emping melinjo was assessed on the basis of growth performance, histology of selected organs, selected blood measures, nitrogen digestibility, and mineral absorption.

In the first experiment, purified diets were used containing 0, 10, 20 or 40 % (w/w) of dried/unfried emping melinjo. The control diet (without emping melinjo) contained casein as sole source of protein and was formulated according to the recommendations of the National Research Council: it contained 5 % of fat. The four experimental diets were balanced for nitrogen, fat, calcium, magnesium and phosphorus. There were 8 male rats per dietary group; the experimental period lasted 14 days. The rats had free access to food and demineralized water.

Feed intake and weight gain were not significantly affected by emping melinjo in the diet. Cecum weight, including contents, was raised markedly after feeding emping melinjo. Feces production rose after consumption of emping in a dose-dependent fashion, but dry matter content fell. Histological examination showed that liver and jejunum were unaffected' by the feeding of emping, but nephrocalcinosis was induced.

The amount of emping melinjo in the diet did not affect hematocrit values and blood hemoglobin concentrations. Plasma triglyceride and cholesterol concentrations were significantly lowered by emping melinjo in a dose-dependent fashion.

Apparent nitrogen digestibility was gradually decreased with increasing emping melinjo concentrations in the diet. The highest dietary concentration of emping used, i.e. 40 %, significantly reduced the apparent absorption of calcium, magnesium and phosphorus.

As a component of the human diet, melinjo is not consumed in its dry form but after frying in coconut fat. It could be suggested that dried/fried melinjo does not negatively affect mineral and nitrogen absorption because eiher possible anti-nutritional factors are denaturated by frying or the nutrients in emping become more accessible to digestive processes. The second experiment was carried out to test this suggestion. In addition, the solubility of minerals in the ileal lumen was determined to obtain clues as to the mechanism underlying the inhibitory effect of emping on mineral absorption. Soluble minerals in the ideal lumen are considered to be available for absorption as opposed to insoluble minerals.

There were three experimental diets: a control diet, a diet containing 40 % dried/unfried emping and a diet containing 40 % dried/fried emping (corrected for the fat taken up while frying). The high-fat diets (15 % fat) were carefully balanced for nitrogen, fat, calcium, magnesium and phosphorus. There were 12 male rats per dietary group, which had free access to food and demi ne ral i zed water; the experimental period lasted 14 days.

Feed intake did not differ significantly between the three experimental groups, but weight gain was some what depressed by both dried/unfried and dried/fried emping. The two emping preparations raised cecum weight and feces production, while the dry matter content of feces dropped.

As was observed in experiment 1, the feeding of dried/unfried emping at a level of 40 % of the diet significantly reduced the apparent absorption of nitrogen, calcium, magnesium and phosphorus. Frying of emping caused disappearance of the inhibitory effect on calcium and magnesium absorption whereas nitrogen and phosphorus absorption were still reduced, albeit to a lower extent.

Dried/unfried and dried/fried emping in the diet raised both the amount of solid and liquid phase in the ileum. The concentrations of soluble calcium and magnesium were decreased by dried/unfried as well as dried/fried emping. The concentration of phosphorus in the liquid phase of the ileal lumen was lowered by dried/unfried but not by dried/fried emping.

The addition of dried/unfried emping melinjo to the diet of rats at the expense of isonitrogenous amounts of nitrogen caused a lowering of the absorption of nitrogen, calcium, magnesium and phosphorus. This effect is either completely or partly abolished by frying of the emping melinjo Frying of dried/emping did not increase the concentrations of calcium and magnesium in the liquid phase of the ileum so that its stimulatory effect on calcium and magnesium absorption remains obscure. Frying of emping did raise the ileal solubility of phosphorus. Frying of emping did raise the Meal solubility of phosphorus. The still some what reduced absorption of phosphorus as seen after the feeding of fried emping is probably the result of unavailable phosphorus as phytate in the emping. The reduced absorption of nitrogen in rats fed either dried/fried or fried emping could relate to the presence of poorly digestible material in the intestine as evidenced by the increased weight of solid phase in the deal lumen. This undigestible material probably represents polysaccharides which raise microbial activity in the cecum leading to the formation of fatty acids and thereby elevating the water content of feces. The undigestible polysaccharides in emping melinjo, if and when present, could also be responsible for its cholesterol lowering activity.