## ABSTRACT

Tamarind (T) or avocado (A) seed was included in diets offered to rats. Its effects on growth performance, blood glucose and cholesterol levels, and glycogen in liver of rats were studied in three different experiments involving two species of rats (Sprague Dawley (SD) and out bred of Wistar-Kyoto rats-SHR (spontaneously hypertensive rats). Basal diet (BD) and high sucrose diet (HSD) containing ground dried of T or A at the following inclusion 2, 4 or 8% were offered to SD rats in experiments 1 (n=28) and 2 (n=28) respectively, while SHR received BD in experiment 3 (n=28). Feed intake, fecal output and body weight were measured; samples of liver were analyzed for glycogen, whereas serum cholesterol and glucose content were determined. The T inclusion in the diet did not affect the feed intake of SD except for the SHR, where the feed intake was lowered at the highest inclusion of T. The increase in the body weight of the rat in the control and experimental group varied during the trials ($p>0.05$) with indications of impaired assimilation of nutrient (i.e. reduced feed efficiency) in SHR after extended feeding on the diet containing T. The digestibility of the diet was not affected by T inclusion in the diet offered to the rats. Feed conversion efficiency was better in SD fed with 2%T than in control (12.5±2.8 and 27.1±2.3 respectively; $p<0.05$) and 4%T in SHR (12.49±2.80) compared to control (0%T; 14.37±1.83; $p>0.05$). Protein efficiency ratio improved only at 2%T (0.53±0.20) in SD offered BD compared to control (0.19±0.02). The serum cholesterol level of SD offered BD was reduced at all level of T inclusion (2%(0.50±0.17g/l), 4%(0.24±0.14g/l), and 8%(0.31±0.06g/l)) compared to control (0.79±0.04g/l; $p<0.05$) whereas the serum glucose levels of the SHR (50.74±2.50mg/dl for 4%T) was lower than control (93.52±10.83mg/dl; $p<0.05$).

Higher liver glycogen content (8%T; 3.43±0.55mg/g) compared to control (1.27±0.24mg/g; $p<0.05$) was found only in the SHR group. The rats fed on diets containing avocado seed showed increased intake of feed. There were indications of impaired assimilation of nutrients (i.e. reduced feed efficiency) in SD rats offered HSD when T was added. The digestibility of the diets was not affected at the inclusion of A in the diet offered to the rats. Feed conversion efficiency was better in 2 and 4 %A (16.78± 0.97 and 15.53±1.58 respectively; $p<0.05$) compared with control (0%A; 27.11±2.28; $p<0.05$) whereas protein efficiency ratio was better in the SD treated groups than the control. The serum cholesterol level of SD offered BD and SHR were lowered with the inclusion of tamarind seed when compared to control ($p<0.05$) whereas the addition of avocado seed lowered the glucose levels at 2%A (21.35±2.29mg/dl) for the SD offered BD compared to control (0%T; 41.72±12.46mg/dl; $p<0.05$). The liver glycogen content increased with the inclusion of avocado seed to the diet of the rats in the treated groups. Tamarind or avocado seed can lower blood glucose and serum cholesterol and also enhance storage of glycogen where included to diet offered to rats. It may also partially influence feed and growth performance though the effect is dose dependent.

## ABSTRAK

Tamarind (T) atau alpukat (A) benih dimasukkan ke dalam diet yang ditawarkan kepada tikus. Kesannya terhadap prestasi pertumbuhan, glukosa darah dan paras kolesterol, dan glikogen di dalam hati tikus telah dikaji dalam tiga eksperimen yang berbeza yang melibatkan dua spesis tikus (Sprague Dawley (SD) dan keluar dibesarkan Wistar-Kyoto tikus-SHR (tikus secara spontan hipertensi) diet pangkal (BD) dan diet sukrosa tinggi (HSD) yang mengandungi tanah yang kering T atau A pada kemasukan berikut 2, 4 atau 8% telah ditawarkan kepada tikus SD eksperimen 1 (n = 28) dan 2 (n = 28) masing-masing, manakala SHR menerima BD dalam 3 eksperimen (n = 28). Pengambilan makanan, pembuangan tinja, dan berat badan diukur; sampel hati dianalisis untuk glikogen, manakala kolesterol serum dan kandungan glukosa ditentukan. Kehadiran T dalam diet tidak menjejaskan pengambilan makanan oleh tikus SD, tetapi menjejaskan pengambilan makanan oleh tikus SHR, dimana pengambilan makanan terjejas pada kehadiran T tertinggi. Peningkatan berat badan tikus dalam kumpulan kawalan dan eksperimen berubah semasa tempoh ujian ($p > 0.05$) dengan tanda-tanda kecekapan makanan berkurangan bagi SHR selepas tempoh ujian pengambilan diet mengandungi T berlanjutan. Penghadaman makanan tidak terjejas dengan kehadiran T dalam diet. Keberkesanan pengubahan makanan adalah lebih baik bagi SD yang memakan 2%T berbanding kawalan (12.5 ± 2.8 dan 27.1 ± 2.3 masing-masing; $p < 0.05$) dan 4%T bagi SHR (12.49 ± 2.80) berbanding kawalan (14,37 ±1.83; $p > 0.05$). Nisbah kecekapan protein meningkat hanya pada kehadiran2% T (0.53 ± 0.20) bagi SD yang diberi makan BD berbanding kawalan (0.19 ± 0.02). Tahap kolesterol serum bagi SD diberi makan BD berkurangan pada semua tahap kehadiran T (2% (0.50 ± 0.17g / l), 4%

(0.24 ± 0.14g / l), dan 8% (0.31 ± 0.06g / l)) berbanding kawalan (0.79 ± 0.04g / l; p <0.05) manakala tahap glukos serum bagi SHR (50.74 ± 2.50mg/dl; 4T%) adalah lebih rendah berbanding kawalan (93.52 ± 10.83mg/dl; p <0.05). Kandungan glikogen hati yang lebih tinggi (8 T%; 3.43 ± 0.55mg/g) berbanding kawalan (1.27 ± 0.24mg/g; p <0.05) hanya didapati dalam kumpulan SHR. Tikus-tikus yang memakan diet mengandungi A menunjukkan peningkatan pengambilan makanan. Kecekapan makanan berkurangan bagi tikus SD yang memakan HSD mengandungi T. Penghadaman diet tidak terjejas apabila A hadir dalam makanan. Kecekapan pengubahan makanan adalah lebih baik pada kehadiran 2 dan 4%A (16.78±0.97 dan 15.53±1.58 masing-masing) berbanding kawalan (0% A; 27.11±2.28; p<0.05). Tahap kolesterol serum bagi BD yang diberi makan kepada SD dan SHR berkurangan dengan kehadiran T berbanding kawalan (p <0.05) manakala kehadiran A merendahkan paras glukosa pada 2% A (21.35 ± 2.29mg/dl) untuk SD ditawarkan BD berbanding kawalan (0 T%; 41.72 ± 12.46mg/dl; p <0.05). Kandungan glikogen hati meningkat dengan kehadiran A dalam diet. Biji asam jawa atau alpukat boleh menurunkan glukosa darah dan kolesterol serum dan juga meningkatkan penyimpanan glikogen di mana termasuk diet yang ditawarkan kepada tikus. Ia mungkin juga sebahagiannya mempengaruhi prestasi suapan dan pertumbuhan walaupun kesan dos bergantung.

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## ABBREVIATIONS

| | |
|---|---|
| PS | Phytosterol |
| DAG | Diacylglycerol |
| NPK | Nitrogen, Phosphorus and Potassium |
| MβCD | Methyl beta-Cyclodextrin |
| HMG-COA | 3-hydroxy-3-methylglutaryl CoA |
| HDL | High density Lipoproteins |
| LDL | Low density lipoproteins |

| | |
|---|---|
| VLDL | Very low density lipoproteins |
| ATP | Adenosine triphospahte |
| NADH | Nicotinamide adenine dinucleotide hydrogen phosphate |
| NAD | Nicotinamide adenine dinucleotide |
| T | Tamarind seed |
| SHR | Spontaneously hypertensive rats |
| SD | Sprague-Dawley |
| BD | Basal diet |
| HSD | High sucrose diet |
| N | Nitrogen |
| FI | Feed intake |
| DM | Dry matter |
| FCE | Feed conversion efficiency |
| PER | Protein efficiency ratio |
| BW | Body weight |
| g | gram (s) |
| HCL | Hydrochloric acid |
| $H_2S0_4$ | Hydrogen sulphate/Sulphuric acid |
| IBW | Initial body weight |
| g/kg | gram per kilogram |
| A | Avocado seed |
| wks | Weeks |