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تأثير التمب كغذاء متخمر منتج من بعض البقوليات على فئران التجارب المصابة بارتفاع مستوى الكوليستيرول

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EFFECT OF TEMPEH AS A FERMENTED FOOD PRODUCED FROM SOME LEGUMES ON HYPERCHOLESTEROLEMIC RATS

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CONCLUSION

1-Using *Rhizopus oligosporus* for tempeh fermentation gave better results than fermentation with *R. stolonifer*, moreover, better results were obtained by using chemical acidification with 0.1% vinegar or 0.85% lactic acid (pH 4 and 4.5) than natural acidification (pH 5.5).

2-The best conditions for production of good soy and lupine tempeh were, acidification with 0.1% vinegar, fermentation with $3.22X10^5$ spores suspensions/ 100 g soybeans or lupine seeds, and incubation at 30^OC for 20 and 28 hr.

3-During tempeh production, protein% and crude fibers% were significantly increased, while fats% and ash% were significantly decreased, in good and acceptable soy and lupine tempeh.

4- Soy and lupine tempeh acidified by vinegar and fermented with *R. oligosporus* have the best chemical properties (high protein% and crude fibers%, and low fats% and phytic acid).

5- Tempeh fermented with *Rhizopus oligosporus* have lower level of microbial load in comparison to tempeh fermented with *Rhizopus stolonifer*. Soy and lupine tempeh fermented with *R. oligosporus* were positive for ABC whereas, those fermented with *R. stolonifer* were found to be positive for ABC and *Staphylococcus*.

6- There is a positive response for all types of prepared soy and lupine tempeh, where tempeh cooked with tomato as well as sweet tempeh showed the highest sensory scores. They were very good in all sensory attributes, Tamiaa and fried tempeh came in the second rank and they were good in all sensory attributes. The lowest sensory attributes were recorded for grilled soy as well as lupine tempeh where it was acceptable

7-Results indicated that feeding hypercholesterolemic rats on 7% of soy and lupine tempeh protein lowered serum cholesterol level by 46%- 48%, and also reduced LDL-c by 72%- 75% as compared to the control (+ve) group. On the other hand, DHL-c was increased by more than 70% in hypercholesterolemic rats fed on 7% of both type of tempeh protein. Meanwhile, feeding on 3.5% of soy and lupine tempeh protein reduced serum cholesterol and LDL-c levels by more than 1/3 and 1/5 as compared to the control (+ve) group. On the other hand, feeding hypercholesterolemic rats on both levels of lupine tempeh reduced triglycerides as well as VLDL-c levels by 36%-42%, comparable to 26%-30% in hypercholesterolemic rats fed on both levels of lupine tempeh protein. While, feeding hypercholesterolemic rats on 7% of soy and lupine tempeh lowered serum cholesterol level by about 46% -48%. Moreover, results showed a controlling effect on the activity of AST and ALT enzymes as well as on the concentrations of uric acid and urea nitrogen in serum of

hypercholesterolemic rats fed on soy and lupine tempeh. Whereas both levels of lupine tempeh lowered the activity of AST enzymes by about 37%, while, the activity of ALT enzyme was lowered by more than 40%. On the other hand, feeding on soy tempeh lowered the activity of AST enzyme in serum of hypercholesterolemic rats by about 10%-30%, comparable to 23%-29%, decrease in the activity of ALT enzyme. Also, there was a marked reduction in the concentrations of uric acid (14.27%) and urea nitrogen (16.5%) in serum of hypercholesterolemic rats fed on 7% of lupine tempeh protein, followed by 19% (urea nitrogen) and 14% (uric acid) in serum of hypercholesterolemic rats fed on 7% of soy tempeh protein. In addition, soy and lupine tempeh when fed to hypercholesterolemic rats at levels of (3.5 and 7% protein) showed a protective effects of hepatocytes against degenerative changes induced by hypercholesterolemia. The best results were obtained at high level. However, the previous benefits combined with an increase in food intake and body weight when fed hypercholesterolemic rats on soy tempeh, while combined with a significant decrease in food intake and body weight when fed hypercholesterolemic rats on lupine tempeh.

RECOMMENDATIONS

1-Fermentation with 10 ml *R. oligosporus*, acidification with 0.1% vinegar and incubation at 30^{O}C for 20 and 28 hr were the optimal conditions for production of soy and lupine tempeh with the best chemical properties and lowest microbial contamination.

2- Storage of tempeh for long periods must be avoided, because the major flatus-related oligosaccharides% increased by storage of tempeh at low temperatures for long periods.

3- Tempeh cooked with tomato, sweet tempeh, tempeh prepared as Tamiaa and fried tempeh are considerable suitable ways for consuming soy and lupine in Egypt, specially cooked and sweet tempeh.

4-Incorporation of soy or lupine tempeh daily in the diet of hypercholesterolemic persons is useful for reducing the levels of bad cholesterol (LDL-c and VLDL-c); and also for elevating the benefit cholesterol (HDL-c) level. In addition soy and lupine tempeh have controlling effects on the hyperactivities of the liver and kidneys functions.

5- Lupine tempeh is recommended for treatment of hypercholestermia in obese peoples, while soy tempeh could be consumed for treatment of hypercholestermia in normal or under weighted peoples.

5-More researches are needed for the investigation of the mechanisms responsible for the performance of hypocholesterolemic function of both types of tempeh.

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