

Thesis Title The Effect of Soy Sauce on Iron Absorption From Thai Diets

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ABSTRACT

In this study the effect of Kikkoman and Maggi soy sauces on iron absorption and iron ionizability were conducted on two exemplary Thai meals: rice-fried egg with ground pork and rice-fried yard-long beans with ground pork. The extrinsic tag method was used for iron absorption study in male volunteers. The absorbed iron that is taken up by red cells was measured by analysing the content of radioirons in blood samples. To facilitate the comparisons of iron absorption from different meals and subjects, iron absorption from a standard reference dose was measured. The absorption value that corresponds to a reference dose absorption of 40% was compared. The in vitro method for determination of ionizable iron was measured in homogenized food sample. After a two-stage (pepsin and pancreatin) digestion, the ionizable iron was extracted by bathophenanthroline into isoamyl alcohol and measured by gamma counter. The absorption ability from the two exemplary Thai meals, were 6.71% and 10.58% respectively. The addition of 10 ml Kikkoman soy sauce into the two meals, increased the iron absorption from 6.71% to 9.19% ($p=0.276$) and from 10.58% to 12.58% ($p=0.371$) respectively, but it was statistically not significant. On addition of 10 ml Maggi soy sauce, no enhancing effect was found, the iron absorption figures appeared to decrease, not significantly, from 6.71% to 5.69% ($p=0.410$) and from 10.58% to 7.82%

($p=0.086$) respectively. In the in vitro study, the addition of Kikkoman showed highly significant enhanced effect on iron ionizability from 7.40% to 11.70% ($p<0.001$) and from 12.89% to 16.14% ($p<0.001$) respectively. The addition of Maggi to the first meal showed no significant increase in ionizable iron from 7.40% to 8.40% ($p=0.057$), and a decrease from 12.89% to 11.77% ($p=0.017$) was observed in the second meal. This finding agreed with the iron absorption results. The poor bioavailability of iron on addition of the Maggi could not be clearly identified except that there are some differences in the manufacturing. Kikkoman is a fermented soy sauce and Maggi is an acid hydrolysed soy sauce. The in vitro ionizable iron was compared with the in vivo iron absorption. They were highly correlated ($r=0.9812$). This experimental in vitro study exhibited reliability in estimating an amount of iron absorbed by human body. In summary, iron availability was found to be significantly improved with the addition of Kikkoman. This improvement could be much better if adequate amount of fermented soy sauce was added to a meal in the presence of not too strong dietary inhibitors. Furthermore, the method for determination of the in vitro non-heme ionizable iron as described in this study was shown to be applicable as a reliable predictor of iron availability.