

# Energy metabolism in relation to diet and physical activity

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# Valorization

## VALORIZATION

Gene-environment interaction has been suggested to be the cause of the rapid increase in obesity prevalence and obesity-related metabolic diseases. In this regard, Asians and Caucasians that differ in genetic background represented partly by differences in body composition and differences in metabolic responses to dietary interventions and physical (in)activity may need different approaches in terms of lifestyle intervention to achieve a more favorable body composition and a low risk of developing metabolic diseases.

The results described in this thesis are written in original articles that have been published in or submitted to scientific journals in the field of nutrition, metabolism, health and obesity. The articles are accessible online for scientists, physicians, nutritionists, health-workers and others who are interested in this topic. The results of the studies have also been presented in the international conferences to colleagues of the same field of interests or of other related sciences. The present studies explore possible differences in energy metabolism of different ethnicities when exposed to similar diet and lifestyle changes by assessing both physiological response and molecular adaptation and by controlling for possible confounders.

Valorization aims to make value out of knowledge. Results from nutrition research are in general highly relevant to be translated to daily life and the results described in this thesis are no exception. There are several aspects of today's lifestyle in relation to the findings of this study that deserve attention.

### **IMPROVING THE DIETARY PATTERN**

In general, current dietary patterns of the Asians (especially in South Asians: Indian, Pakistani, etc.; and in Southeast Asians: Indonesian, Malaysian, etc.) are characterized by a large amount of carbohydrate intake (>55% of the calorie intake), a low protein intake (< 10% of the calorie intake) and a high saturated fat intake. This typical dietary pattern may

have to be improved to achieve healthier metabolic profiles. High carbohydrate intake has been associated with high plasma TAG concentrations and low HDL-cholesterol concentrations in a population study. Thus over time, high carbohydrate (and/or sugar) intake may contribute to the development of dyslipidemia. We confirmed in our study, when the proportion of carbohydrate was reduced, TAG concentration decreased. On the other hand, we have shown that high-fat diet have an adverse effect on total and LDL-cholesterol in this population. Although differences in cholesterol metabolism between ethnicities need to be further investigated, defining a suitable macronutrient composition for Asian dietary patterns deserves further study.

Body mass index, age, gender and physical activity are important factors in determining energy requirements of different individuals in the population. However, physical activity may have to be emphasized as an important factor when advising macronutrient composition of the diet for different individuals, as there is a coordinated regulation between carbohydrate and fat oxidation to fulfill energy requirements, where glycogen depletion plays an important role as discussed in this thesis.

## **REGULATION ON COMMERCIAL FOOD PRODUCTS**

Urbanization and modernization are responsible for several changes in people's lifestyle such as the increasing demand for a fast (ready-to-eat) and convenience food that optimizes ease of consumption or a more frequent dining-out due to having no time for preparing a meal at home. Although these convenience foods indicate improvement in food technology, some of them have received criticism due to imbalanced nutrient content such as high-fat content, high-salt content, low-fiber content or high-sugar content as well as the misuse of food preservatives and food additives.

Excessive intake of these typical foods over a long period of time will contribute to the development of obesity and other health problems, as we have shown for a high-fat diet.

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Thus, the challenge remains how to use food technology to produce healthy convenience foods in this modern world. Whereas at the same time, government should take responsibility on law enforcement and regulation, such as pushing the industries to cut back on sugars, fat, *trans*-fat and salts found in food products, introducing low-calorie products and reducing portion-size, as well as targeting taxes and levies onto the unhealthy products.

## PROMOTING AN ACTIVE LIFESTYLE

We showed that Asians have a lower fat-free mass/appendicular skeletal muscle mass than other ethnicities. This characteristic may cause this population more susceptible to the negative effect of being sedentary, as it may affect glucose disposal. The results of this thesis indicated that South Asians have an adverse glucose and insulin metabolism as compared to Caucasians when consuming a high-fat diet under sedentary condition. Whereas, no difference being observed between ethnicities in the glucose and insulin response to overfeeding under free living condition. This suggests that an active lifestyle may help to improve glucose metabolism in obesity-prone individuals like Asians. In addition, physical activity guidelines may be important to be addressed that differ from those in Caucasians.

The period of the present study may not be long enough to show apparent differences between ethnicities, however based on the early response of glucose, insulin and cholesterol metabolism when adopting unhealthy lifestyle, there is a potential that the metabolic disturbance will develop more severely in the long-term in Asians.

## EARLY PREVENTION

The development of obesity (increased fat mass) is genetically determined but also there is a significant influence from the environment during the life course; whereas fat-

free mass is consistently reported to be influenced by birthweight. Thus, to obtain a favorable amount of fat-free mass in the future adult-life, the effort must be started from the period of pregnancy to supply with good nutrition and other elements of a healthy lifestyle.

Healthy lifestyle must also be introduced as early as possible to children. Home and school should share responsibility in educating children, to help them understand how importance to have a healthy diet and an active daily life by moving and playing outside. This should go beyond increasing knowledge but more active involvement. Children are not too young to be taught about nutrition through kitchen and food gardens for instance. Teachers could also ask children to bring fruits and other healthy snacks for their morning and afternoon break. By doing this, they will be well-equipped with healthy living behavior. When they are approaching puberty and adult life and facing choices about their behavior that, if they choose inappropriate lifestyle could impair their health, they will choose otherwise.

## **TARGET GROUPS**

### ***Health professionals***

Health professionals are knowledgeable people with sufficient skill to handle health problem in the society. In the case of promoting a healthy diet and an active lifestyle, physicians, nutritionists, dieticians, nurses are capable of doing that and must work together through advising the patients during visit, educating people both institutionally or colloquially, campaigning through media or focus group discussion. The aim is to make ordinary people aware of and well-informed about healthy living behavior. However, encouraging people in the society will not be effective without active involvement. People need example and perhaps role model, thus they should be approached in a more creative

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way to be willing to change their habit towards a more positive attitude with respect to lifestyle.

### ***Government***

Government has full authority to issue some regulations and policies that assure the well-being of the citizens. Policies targeting food and nutrition are needed across several sectors like agriculture, (food) industries, trades, health, social welfare and education. A tight regulation towards global market of fast-foods that have been shown to be one of several aspects that trigger obesity epidemic is a must. In addition, regulation on food safety, food production, food processing, food packaging, food-labelling and food distribution must be accompanied by law enforcement. Economic incentives such as subsidies must be given to growers/farmers to sell healthy and fresh products and to food industries to produce healthy and safe food products. On the other hand, disincentives such as cutting subsidies and targeting tax must be taken to slow or reverse the production and distribution of unhealthy food products.

When it comes to promoting active lifestyle, government should take responsibility in providing more safe and friendly public spaces as well as facilities at school, in the neighborhood or other areas in the city, for children to play outside and people to move more in a nice and convenient environment. Safe pedestrian path and bicycle path should be provided to encourage people to be more physically active. On the other hand, increasing park fees, vehicle tax and cutting subsidies on fuel for private transportation may help to discourage people to use vehicle unless necessary.

### ***Mass Media***

The mass media play an important role in spreading information in this modern world. Broadcast media (TV, radio, film) and digital media (internet and mobile) are able to reach

a larger audience than print media or outdoor media (billboards) these days. Thus it is a useful tool for educating, promoting, advertising and campaigning a healthy lifestyle. Although advertisement revenue provides a significant portion of the funding for most privately owned television networks, it is important to be selective and apply tight regulation on commercials/advertisement that promote unhealthy products especially those targeting children. Instead, providing more slot to advertise healthy (food) products.