

# Working out what you should eat

**What constitutes a healthy diet for one person can be quite the opposite for another. Nutrition researchers are looking for the reasons for these individual differences and their implications for our diets. Ultimately they want to be able to offer consumers personalized dietary advice.**

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**‘D**ear Mrs X, we have just checked your health status using our apps. It would be sensible for you to eat more high-fibre products in the coming months. Your cholesterol level is on the high side and the biodiversity of the microbes in your bowel is less rich than it was six months ago. We recommend you eat at least four slices of wholemeal bread a day, a slice of gingerbread with your coffee, and include mushrooms in your evening meal twice a week. Kind regards, your digital dietician.’ Far-fetched? Well, not entirely. In the Personalized Nutrition and Health programme, research organization TNO and Wageningen UR are working with companies on this kind of future scenario. ‘For the next year we have a budget of two to three million,’ says Liesbeth Luijendijk, Business Development Manager Food Informatics at Food & Biobased Research, part of Wageningen UR. ‘At Wageningen UR that enables 15 to 20 researchers to get to work.’ TNO and Wageningen UR want to assess the health status of individuals using all sorts of portable gadgets such as step counters, heartbeat meters, blood samplers and apps with which people can easily record their sleeping patterns or their daily intake of foods or drinks. The data that are obtained in this way from all the participants in the study are analysed. ‘On the basis of this together with the latest scientific insights, we want to find out whether we can then offer consumers automatically generated personal dietary advice,’ says Luijendijk.

### **GOOD FOR US**

But surely we know what’s good for us? Do we really need those apps and portable equipment to tell us that? Just follow the dietary guidelines published by the Dutch Health Council last year and you can’t go

wrong. Not so, think nutrition scientists. What is healthy or effective for one person does not have to be good for another. Gradually, more and more evidence of this is emerging.

At the end of last year the academic journal *Cell* published an interesting article. Researchers at the Israeli Weizmann Institute registered the daily intake and blood sugar levels of 800 healthy people over a week. And what did they find? People who ate exactly the same breakfast in the morning could have totally different blood sugar levels two hours later. For one person it shot up to dangerous levels, while for another it remained normal.

When the researchers correlated the test subjects’ blood sugar levels with the amount of sleep, physical activity, food intake and the composition of the gut microbiota (the new term for gut flora), they found they could predict for each individual how their blood sugar would react to a particular meal. When they then gave a group of people a meal which matched their physiology, their glucose levels improved and the composition of their microbiota changed. The striking finding was that a diet that was good for one person’s blood sugar did not work for another person.

### **DIFFERENCES ESTABLISHED**

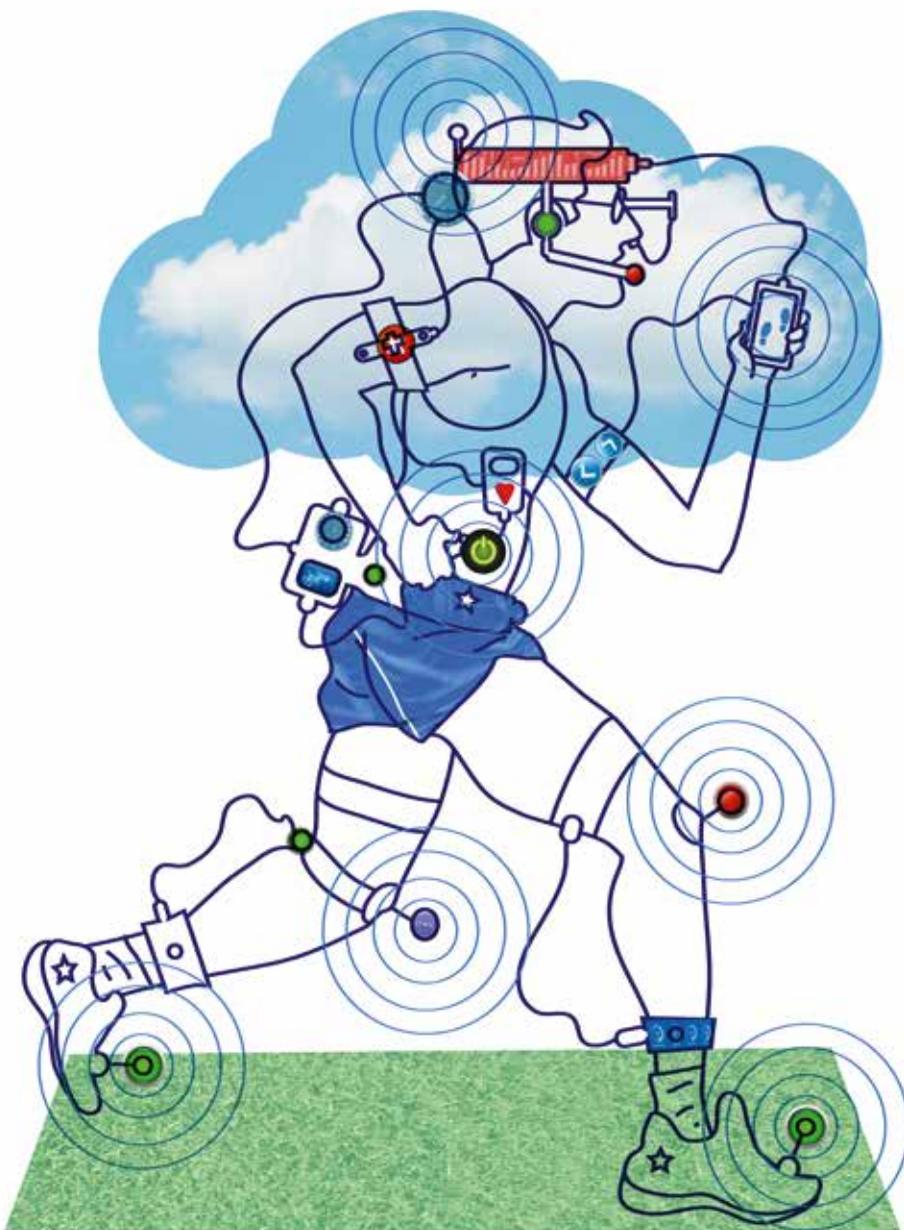
‘This is a very nice study,’ says Edith Feskens, professor of Nutrition and Health over the Lifecourse at Human Nutrition in Wageningen. ‘Never before have the differences been so precisely established for such a large group of people. The study must of course be repeated first to be sure that the results were not coincidental. But if these findings are true, it would seem that there really is a future for personalized nutrition.’ Personalized Nutrition – the idea that indi-

vidual differences exist in dietary needs and that you should bear them in mind to achieve optimal health – has been a buzzword in nutrition studies for a few years now. It has been known since the 1950s that there were individual differences but no one knew how you could make use of them. When human DNA was first decoded in the year 2000, many nutrition scientists thought they had got hold of a good instrument. They speculated about diets that were adjusted to an individual’s specific genes. ‘For example, we expected to be able to predict on the basis of certain genes whose cholesterol would go up,’ explains Feskens, who was working for the Dutch National Institute for Public Health and the Environment (RIVM) at the time. ‘We would be able to prevent that using diet.’ But little came of her study and that of her overseas colleagues. The effects were small, not easily explained, and the results were contradictory. ‘We were working in too limited a way: genes are too static and they only tell you whether a particular protein can be manufactured, not whether that actually happens. Using techniques that measure the activity of genes we can now look at exactly what is happening in the body at a given moment. This will probably help us understand how individual differences come about.’ But she reserves judgement. ‘In the past we promised too much. Let’s wait and see first what comes out of the research,’ says Feskens.

### **ACTIVE GENES**

Lydia Afman is one of the researchers at Human Nutrition who is using these new methods to look for individual differences. She looks at which genes become active when a person consumes a certain food-stuff. Which proteins are formed, where in the body, and what do they tell us about the

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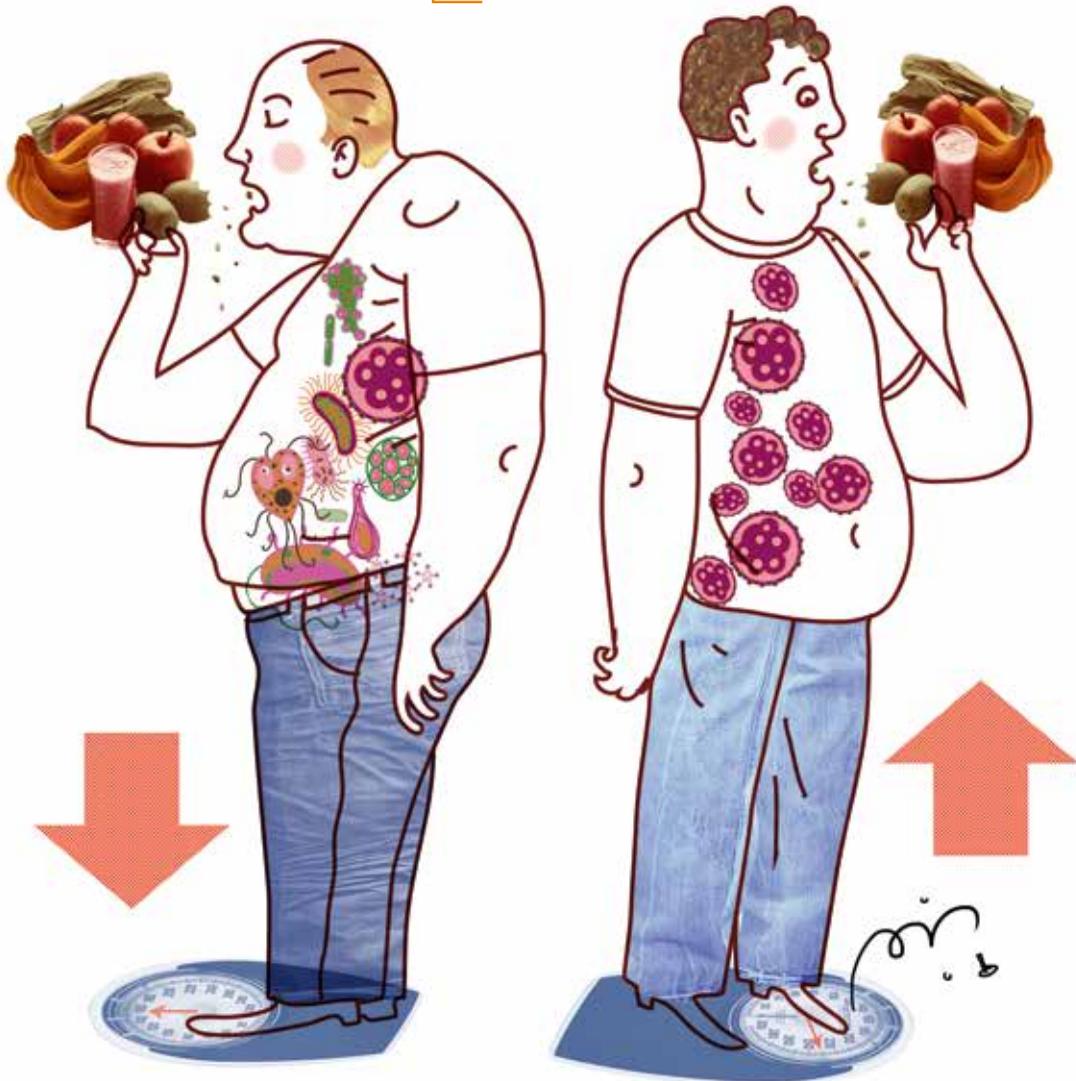
person's physiology? Thin people and fat people, for instance, respond differently to a drink containing dissolved saturated fat, her research group showed in a pilot study. The activity in 600 genes (humans have 20,000) was different in the two groups. And when both groups were given a drink containing monounsaturated fats, as many as 2500 genes responded differently. 'In follow-up studies we shall try to find out what this means,' says Afman. 'We don't just look at the gene activity and the proteins which are formed, but also at the cholesterol level, the glucose level and the blood pressure. By combining and analysing the data from all these factors we hope to gain more insight.'

### STRESS TEST

She is doing this in two follow-up studies: the Wageningen Belly Fat project, initiated and implemented by Human Nutrition, and the European Nutritech project. In both projects people have been subjected to a 'challenge', just like the test subjects in the pilot study. Afman: 'We looked at how different people react if they are put under pressure in their diet – a lot of sugars or fats – and through exercise. So it's a kind of stress test.' Subsequently some of the group went on a diet and some did not, after which both groups went through another challenge test. In the Belly Fat project there is more emphasis on organ health than in the Nutritech project. One group, for instance, was put on a diet rich in substances that nutrition scientists believe to have beneficial effects on fat tissue, the liver, heart, blood vessels or bowel.

There are no results yet from either of the projects but Afman is willing to say something about what she hopes to discover. 'We think there is a relation between >

## ‘Your gut bacteria can determine how you react to a diet’



### SMELLING HEALTH

Jurriaan Mes of Food & Biobased Research, one of the Wageningen researchers who will be involved in the Personalized Nutrition and Health (PNH) project, wants to develop a breath test. 'There are a lot of volatile substances in the breath. Some of them can tell us something about our health, for example whether there is any inflammation in the gastro-intestinal tract. We want to study which substances indicate that and see how we can go from the kinds of large machine we have in our lab to a little gadget that you link to your smartphone.'

He is also trying to link up his EU project Fibebiotics with the PNH programme. In this project he studies whether fibre in foods such as grains or mushrooms reinforce the immune systems of elderly people. Mes: 'This is seen in tests on cells and lab animals; now we shall study it in elderly people themselves. We shall also try to find out why fibre does have an impact on the immune system in some people and not in others.' This knowledge can then be used in the dietary advice that consumers can get, based on their health status.

the flexibility of the body – how fast it can absorb sugars and fats, for example, from the blood – and a person's health. The more flexible the healthier. We are looking for substances which indicate that something is going wrong before people are heading for full-blown diabetes or cardiovascular diseases. Then you can change your diet in time. And we hope to find out why some people do respond to a particular diet and others don't.

### MICROBES IN THE GUT

It is not just a person's gene activity that determines how they react to their food; the mix of microbes in their gut plays a role in it too. In a 2013 study Wageningen professor of Microbiology Willem de Vos and colleagues of his in England and Finland showed that the gut microbiota of a small group of obese men reacted in different ways when they were first put on a high-starch diet and then on a high-fibre one.

There was a bigger change in the gut microbiota of people with low diversity of microbe species than in those with high diversity. What is more, the people in whom the microbe species changed after eating a high-fibre diet then had healthier cholesterol levels. So the switch to a high-fibre diet was good for them, whereas for the people with a highly diverse gut microbiota the change of diet made little difference. De Vos: 'These findings have been confirmed 'in other studies.'

A large-scale French study, also done in 2013, showed that obese people whose microbiota consists of many different species benefit more from weight loss than obese people whose microbiota includes few species. In people with high diversity there is a change for the better in certain inflammato-

ry markers – substances in the blood which indicate, in combination with the cholesterol level, whether a person is at risk for cardiovascular disease. 'In people with low diversity this happens to a significantly lesser extent,' says De Vos. 'So the composition of your microbiota can determine how you react to a diet. And in turn, your diet has an effect on the composition of your microbiota.'

### DIET FORMULA

The Israeli researchers at the Weizman Institute made use of this knowledge. They related the composition of the microbiota of individuals to what they consumed, their glucose levels, and the amount of sleep and physical exercise they got, and arrived at an algorithm – a formula – with which they could predict which diet would have a beneficial effect on the glucose level in which people. In the Personalized Nutrition and Health (PNH) programme, TNO, Wageningen UR and food companies want to develop this kind of algorithm – but then based on a lot more nutritional and health factors.

'We are trying to establish the relation between all those health elements and diet, as well as to find new links. We then use this as the basis for personal digital dietary advice,' says Liesbeth Luijendijk. Even for already established links between diet and health, she thinks daily tracking of intake and health indicators with apps and portable equipment can be helpful. 'People with high blood pressure know they should be on a low salt diet but they are often unaware of how much salt they consume in a week because they don't monitor it closely and they don't know exactly how much salt products contain.'

TNO and Wageningen UR see an important

role in the project for the supermarket chains. The consumer logs in at an online supermarket with the digital dietary advice and is told which products fit the bill. Luijendijk: 'If he has high blood pressure, he is offered low salt products or recipes that don't use too much salt. That is in the supermarket's interests as well. They want to sell bulk products such as soft drinks and crisps, but they are also keen on customer loyalty and to go along with the trend for healthy products.'

But will there be consumers who want to work on their health so intensively?

Luijendijk: 'We are going to do research on that. In any case we expect to reach a bigger group of consumers than we do now. The consumers who don't go to see a dietician but who would like to improve their health. For them the personal digital advice probably seems more within their reach. And seeing so clearly what a certain food does to their bodies might motivate consumers to monitor their diet better.' ■

### WAGENINGEN ACADEMY

Wageningen Academy will run a course on Protein in senior nutrition in April 2016.

The course offers new insights into the effect of protein on intestinal health and muscle mass in older adults. [www.wageningenacademy.nl/course\\_seniorproteins](http://www.wageningenacademy.nl/course_seniorproteins)