

onbekende risico's, hoe klein deze toch al mogen zijn en maakt daardoor de additievenconsumptie extra veilig.

Ten onrechte wordt soms gesuggereerd dat ons voedsel onveilig is door het additievegebruik. Ik wil daarom dit verhaal besluiten met een overzicht van de in ons eten verborgen risico's. Het lijstje dat ik geef, is opgesteld door WODICKA (7), destijds directeur van het Bureau Levensmiddelen van de FDA en wordt inhoudelijk bevestigd door andere gezaghebbende auteurs als CRAMPTON (2). Volgens WODICKA zijn de risico's van voedselconsumptie in volgorde van afnemend belang:

1. voedselvergiftiging als gevolg van microbiële infectie
  - a. rechtstreeks door salmonellae, stafylococci, streptococci e.d.;
  - b. d.m.v. geproduceerde toxinen: botulisme, aflatoxine e.d.;
2. verkeerde voeding (teveel, eenzijdig);
3. milieucontaminanten (kwik, PCB's e.a.);
4. van nature aanwezige toxische stoffen (b.v. alkaloiden, waaronder solanine in aardappelen);
5. bestrijdingsmiddelresiduen;
6. functionele bestanddelen (= additieven).

Een veel voorkomende bacteriële voedselinfectie is de salmonellose, ook bekend als zomergriepje en 'toeristje'. We hebben er allen wel eens aan geleden, ook al herkennen we hem misschien niet als zodanig.

Dat de additieven met de bestrijdingsmiddelen onderaan staan, is eenvoudig te verklaren: ze worden toegelaten na gedegen toxiciteitsonderzoek met maximum gebruikshoeveelheden waarin een veiligheidsmarge zit die veel groter is

dan die welke op veel contaminanten en natuurlijke bestanddelen zou kunnen worden toegepast zonder de voedselvoorziening onmogelijk te maken. Zo is bijvoorbeeld van wijn het natuurlijke gehalte aan aminen als histamine in combinatie met alcohol de oorzaak van hoofdpijn na wijnconsumptie (3) en niet het toegevoegde sulfiet zoals nog wel wordt beweerd.

Grotere veiligheid van ons voedsel bereiken we als consument dan ook niet door het vermijden van additieven, want die behoren tot de best onderzochte bestanddelen van ons voedsel en zijn in hun beperkte toepassing al zeer veilig, maar – met een blik op het lijstje van WODICKA – door hygiënisch bereid voedsel tot ons te nemen en verder door de bestaande en onvermijdelijke risico's te spreiden, dus door gevarieerd en matig te eten en te drinken.

#### Literatuur

1. **Algemene richtlijnen** van de Voedingsraad. Toevoeging van hulpstoffen aan voedingsmiddelen voor de mens. Verslagen, Adviezen en Rapporten 1974. Voeding **35** (1974), 9.
2. **Crampton, R. F.:** Health and food chemicals. Roy. Soc. Hlth j. **197** (1977), 197; 238.
3. **Fröhlich, D. en R. Battaglia:** HPLC-Analyse von biogenen Aminen in Wein. Mitt. Geb. Lebensm. Hyg. **71** (1980), 38.
4. **Hansen, S. C.:** Acceptable daily intake of food additives and ceiling on levels of use. Fd. Cosmet. Toxicol. **4** (1966), 427.
5. **Hansen, S. C.:** On an ADI-budget. Oral statement at the EEC colloquium 'Conditions of Use of Food Additives'. Brussels, 19-21 June 1978.
6. **De richtlijnen** voor de bepaling van de veiligheid van levensadditieven. Tiende reeks in de serie Verslagen van het Wetenschappelijk Comité voor de Menselijke Voeding. EUR 6892. Commissie van Europese Gemeenschappen. Brussel 1980.
7. **Wodicka, V. O.:** Food safety in 1973. Flavour Indust. **1973**, 292.

## Food consumption pattern of the Dutch population in 1978

### Application of a qualitative history recall method

**Summary.** By a qualitative dietary history recall method, which was validated on quantitative data and applied, in 1978, on a probability sample (n=1951) of the Dutch adult population, the quality of the food consumption pattern was evaluated.

For assessing the preventive value of the diet, a food scoring

by Ir. F. J. KOK\*

Dr. A. W. MATROOS\*\*

Prof. Dr. J. G. A. J. HAUTVAST\*\*\*

Prof. Dr. Ir. A. W. VAN DEN BAN\*\*\*\*

system based on the criteria of a prudent diet was constructed. In this way it was possible to compute for each participant in the national survey a so called 'nutrition score', illustrating his or her type of diet.

The main conclusion is that adherence to dietary recommendations is not yet common practice in the Netherlands. An estimated 4 percent of our study population meets the standards of a prudent diet.

The developed recall method yields results that seem to be applicable in public health programs in which the need for nutrition education in dietary intervention is addressed.

#### Introduction

Nutrition education in programs for the prevention of coron-

\* Nutritionist, Dept. of Epidemiology, Neth. Heart Foundation, The Hague

\*\* Epidemiologist/statistician, Neth. Heart Foundation, The Hague

\*\*\* Head Dept. of Human Nutrition, Agricultural University, Wageningen

\*\*\*\* Head Dept. of Extension Education, Agricultural University, Wageningen

ary heart disease (CHD) needs to know to what extent the diet of a target group is preventive for cardiovascular disease. To get such knowledge usually requires quantitative data on total food intake over several days.

In diet intervention studies a form of a food scoring system has occasionally been used to express the quality of the diet (5,7). In the nutritional counseling program of the Multiple Risk Factor Intervention Trial (MRFIT), efforts were focused on methods of monitoring the dietary intake of fat and cholesterol. Here a self calculable food score for participants served as a dietary assessment device and a nutrition teaching aid (12). For evaluation of the overall effectiveness of intervention the nutrition counselor used a food record rating, indicating the dietary adherence to the MRFIT eating style (11).

The objective of this investigation is to assess the quality of dietary patterns in groups by means of a short recall technique. Therefore we developed a qualitative recall method, validated it on quantitative data, and applied it to a probability sample of the Dutch population. To indicate the preventive value of the diet a food scoring system, based on the criteria of a prudent diet (1,4), was constructed.

In this article qualitative data concerning the food consumption pattern of the Dutch adult population and the extent to which it meets the standards of a prudent diet in cardiovascular preventive terms, are presented.

## Methods

Food consumption patterns of the Dutch adult population were evaluated in a study (9) designed to support and guide public health education regarding cardiovascular risk factors like smoking, nutrition, obesity and physical activity.

The data on nutrition were collected through a national survey among the Dutch adult population in 1978. A random sample of 1062 women and 889 men aged 18 to 64 years was interviewed with the help of a partially structured questionnaire, which was developed in a 1977 pilot study among 150 individuals. The response rate was 77%. There were 14% refusals, 9% could not be reached.

## Questionnaire

The food consumption pattern was qualitatively measured

by a diet history recall, an interviewing method seeking to discover the 'usual' diet and relying on the memory of the subjects (8).

By means of this method one gets information on selection and intake frequency (per day or per week) of certain food products and this information can serve as an indication of an individual's type of diet; data on quantitative food intake are not collected.

The questionnaire focusses on nutrients considered as important in a diet aiming at prevention of cardiovascular disease, such as: fats, polyunsaturated fats, simple carbohydrates, cholesterol, dietary fibre, and alcohol (table 1).

The assumption is that the individual's consumption frequency of certain food products is indicative for the intake of the above mentioned nutrients, e.g. frequency of egg and liver consumption for the cholesterol intake or bread and fruit for dietary fibre.

## Food scoring system

To indicate the quality of an individual's diet the nutritionist formulated a food scoring system using the criteria of a prudent diet (1,4) as a standard. The rationale behind the scoring procedure is that frequent use of foods which are optimal respectively less optimal from a preventive point of view leads to a high respectively low score. To illustrate this, the scoring system for some arbitrary products out of the questionnaire, namely yogurt and eggs, is reproduced in table 2. Analogously all foods included in the questionnaire are given a score between 1 and 5, depending on the individual's consumption frequency. By summarizing the scores for all food products each subject can be given a 'nutrition score' illustrating his type of diet\*.

Since the questionnaire includes 17 food products, the nutrition score can range from a minimum of 17 to a maximum of 85 points. An individual who follows the requirements of a prudent diet would get at least 4 points for each food product with this scoring system, thus leading to a total of 68 points.

\* Further details of the scoring mechanism as well as the questionnaire are available from the first author.

**Table 1. Selection and intake frequency of food products in the Dutch adult population in 1978. Results of a national survey (n=1951)**

Food products	Weekly consumption						
	every	5 or 6	3 or 4	1 or 2	< 1	never	
	day	days	days	days	days	%	
	%	%	%	%	%	%	
<b>Cereals, meal and mealproducts</b>							<b>Graaen, meel en meelprodukten</b>
bread for breakfast	73	3	2	5	—	17	brood als ontbijt
rolled oats, breakfast cereals	3	2	1	6	—	88	havermout, brinta of muesli als ontbijt
bread for lunch/second breadmeal	78	8	2	3	—	9	brood als lunch/2e broodmaaltijd
brown bread (5)	50	4	10	6	—	30	bruinbrood
white bread (5)	25	3	9	15	—	48	witbrood
wholewheat bread (5)	21	2	7	11	—	59	volkorenbrood
potatoes	33	43	13	5	2	4	aardappelen
rice	1	1	3	31	46	18	rijst

**Meat and meatproducts**

meat at dinner	35	42	15	4	2	2
minced meat (no minced beef) (1)			3	54	30	13
smoked sausage (cooked) or pork sausage (1)			1	30	48	21
bacon (fat, fresh) (1)				18	37	45
cutlet (1)		1	6	49	31	14
poultry		1	1	26	61	11
fish	1		1	30	52	16
liver or kidney (4)				6	33	61

lean meat products (roast beef, lean bacon etc)	27	5	24	25	8	11
luncheon meat, cooked sausage or other sausages	12	2	13	28	14	31
liver sausage, liver pie or liver paste	6	1	9	29	23	32

**Milk, milkproducts and eggs**

milk (see Beverages) (1)						
yogurt (whole milk) (1)	7	4	11	19	-	59
yogurt (skimmed milk) (1)	8	4	9	16	-	63
cheese (full cream or 40+) (1)	49	9	16	15	-	11
cheese (20+) (1)	6	1	3	4	-	86
custard of porridge (3)	10	2	13	32	18	25
desserts (industrial prepared) (3)		1	1	11	19	68
eggs (see Other food products) (4)						

**Fats and oils**

margarine on bread (2)	26	1	2	1	-	70
halvarine (40% fat) on bread (2)	35	2	1	1	-	61
dietmargarine (≥60% pufa) on bread (2)	16	1	1	1	-	82
butter on bread (2)	13	1	3	10	-	73
peanut butter	3	1	5	11	15	65
shortening/cooking oil (see Other food-products) (2)						

**Vegetables and fruits**

vegetables at the dinner	63	29	6	1	1	
vegetables or fruit on bread	3	1	5	17	22	52
fruits in syrup for or at dessert (3)		1	2	15	35	47
fruits (see other food products) (5)						

**Snacks**

salty biscuits or potato crisps (1)		1	6	29	33	31
peanuts or other nuts (1)		1	3	27	38	31
croquettes of minced meat balls (1)			1	15	36	48
potato chips or French fries (1)			1	22	41	36
biscuits (3)	1	1	4	23	26	45
cakes, tartes or pastries (3)		1	3	30	47	19

**daily consumption**

Foodproducts	≥12	11	10	9	8	7	6	5	4	3	2	1	<1	0
	%	%	%	%	%	%	%	%	%	%	%	%	%	%

**Beverages**

-non alcoholic:														
glasses of whole milk (1)								1	1	3	8	16	8	63
glasses of low fat milk (1)									1	3	7	10	5	73
glasses of skimmed milk (1)											1	3	2	94
glasses of buttermilk (1)									1	1	4	10	17	67

cups of coffee	3	4	1	6	4	12	3	20	14	13	5	1	4
cups of tea		1	1	2	3	5	12	12	27	17	5	15	

glasses of softdrinks like 7up, coke (3)									1	2	5	18	34	40
glasses of fruitjuice (3)									1	1	3	15	33	47

**Vlees en vleeswaren**

vlees bij de warme maaltijd						
gehakt (geen tartaar)						
rookworst of verse worst						
speklappen						
karbonade						
kip						
vis						
lever of niertjes						
magere vleeswaren (rosbief, magere ham e.d.)						
boterhamworst, gekookte worst of andere worstsoorten						
leverworst, leverpastei of pâté						

**Melk, melkprodukten en eieren**

melk (zie Dranken)						
gewone yoghurt						
magere yoghurt						
gewone kaas (volvet of 40+)						
magere kaas (20+)						
vla of pudding						
kant-en-klaar toetjes						
eieren (zie Overige)						

**Oliën en vetten**

gewone margarine op het brood						
halvarine op het brood						
dietmargarine op het brood (2)						
roomboter op het brood						
pindakaas						
spijsvet-olie (zie Overige)						

**Groente en fruit**

groente bij de warme maaltijd						
groente/fruit op het brood						
vruchten op sap als of bij het nagerecht						
fruit (zie Overige)						

**Snacks**

zoutjes of chips						
pinda's of andere nootjes						
croquetten of frikadellen						
patat frites						
grote koeken b.v. gevulde koeken						
gebak of cake						

**Dranken**

-niet alcoholisch:						
glazen volle melk						
glazen halfvolle melk						
glazen magere melk						
glazen karnemelk						

koppen koffie						
koppen thee						

glazen frisdrank bv 7 up of cola						
glazen vruchtensap						

-alcoholic:																-alcoholisch:
glasses of beer (6)			1	1	1	2	4	5	7	22	57					glazen bier
glasses of sherry, port of vermouth (6)									1	2	5	23	69		glazen sherry, port of vermouth	
glasses of wine (6)									1	2	5	35	57		glazen wijn	
spirits (6)									1	2	4	7	23	63	borrels	

<b>Other food products</b>															<b>Overige</b>
sugar use (3)	amount of spoonfuls in:														suikergebruik:
		>3	3	2½	2	1½	1	½	0						
		%	%	%	%	%	%	%	%						
	coffee	1	3	1	20	6	26	5	38						koffie
	tea	1	3	1	19	4	27	6	39						thee
egg use (4)	amount of visible, non-processed eggs at one week														eiergebruik
		>7	7	6	5	4	3	2	1	<1	0				
		%	%	%	%	%	%	%	%	%	%				
		3	2	2	4	7	16	30	20	10	6				
use of shortening/cooking oil (2)	to bake or to fry														gebruik van spijsvet/olie
	oils														9%
	shortenings														83%
	combination shortenings/oils														6%
	no shortenings/oils														2%
fruit use (5)	daily consumption														fruitgebruik
		>4	4	3	2	1	<1	0							
		%	%	%	%	%	%	%							
		2	2	11	29	34	15	7							

- : not asked  
blank: less than 0,5%

Food products with a figure between parentheses have been used to construct the nutrition score.  
The meaning of the figures is as follows:  
the food product is indicative for:

- (1) fat
- (2) polyunsaturated fats
- (3) simple carbohydrates
- (4) cholesterol
- (5) dietary fibre
- (6) alcohol

**Table 2. Examples of the food scoring system**

<b>Food product</b>	<b>Response categories</b>	skimmed milkyogurt: 1 or 2/3 or 4 day/days	4
How many days in a week do you eat on the average?	every day 5 or 6 days 3 or 4 days 1 or 2 days never	skimmed milkyogurt: 5 or 6/every days/day	5
whole milk yogurt	- - - - -	How many eggs do you eat in a week on the average? (visible, non-processed eggs)	
skimmed milk yogurt	- - - - -		
<b>Scoring system:</b>		<b>Scoring system:</b>	
<b>Frequency of use</b>	<b>Score</b>	<b>Frequency of use</b>	<b>Score</b>
whole milkyogurt: every/5 or 6 day/days	1	never	5
whole milkyogurt: 3 or 4/1 or 2 days/days	2	1 egg or less	4
never yogurt or a combination of whole and skimmed milk yogurt	3	2 eggs	3
		-	-
		3 eggs or more	1

### Validity

The validity of our qualitative method, i.e. the food scoring system, was evaluated using dietary data gathered in a rural population (n=100) in Rhenen (14) by a seven-days-record method. For this population the consumption frequency of foods was known through keeping of note-books. The quantities consumed were also recorded.

Our questionnaire has been applied to these data. Based on the consumption frequency, written in the note-books, each individual in the Rhenen population was given a score for each of the food products included in our questionnaire. The scores were awarded according to our food scoring system. To verify the validity of the scoring procedure we compared the nutrition score with the nutrient intake, which was known for all Rhenen subjects. To this end both distributions were divided into five classes. The hypothesis of equal ranking by the two classifications was checked by means of Spearman's rank correlation coefficient ( $r_s$ ) (13).

The comparison has also been carried out for separate scores of the composite nutrients (table 3). The assumption that our method can adequately classify people on account of their dietary habits is supported by the coefficient  $r_s$  of 0.58 for the overall nutrition score. Classification on the basis of single nutrients however is in view of some low correlation coefficients not recommended. The phenomenon that a number of rather insensitive tests can be combined to one adequate classification instrument was earlier observed for coronary risk functions (15).

Another question is whether relying on a respondent's memory, in an interview situation (dietary recall), would

produce essential bias, compared with recording food intake, since people tend to forget their (bad) eating habits. This should have been tested ideally in the Rhenen population, but such data were not available. However a comparison of the distributions of the nutrition score of the Rhenen population and our study population shows that the two distributions are practically equal (figure 1). So apart from possible bias by differences in the structure of the two populations, we have no reason to fear major problems given the results of the validity test in table 3.

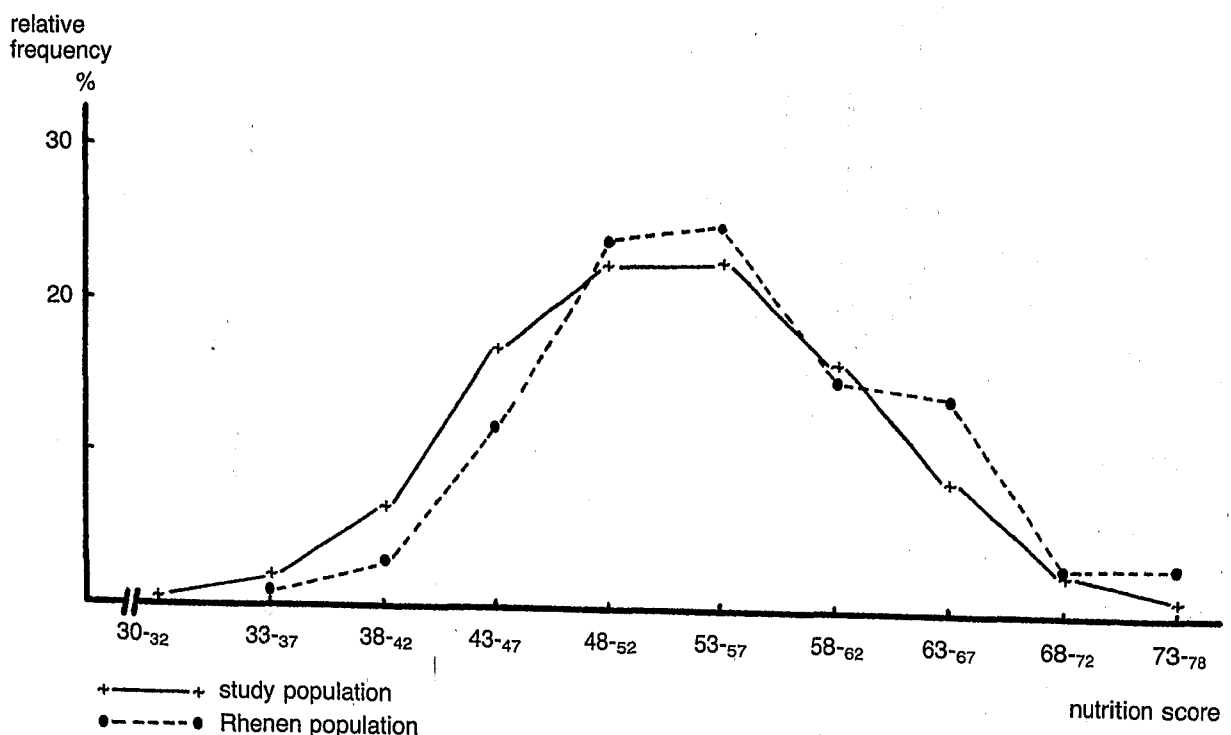
In the presentation of the data the study population was divided into three categories of dietary patterns. We labeled them *undesirable* (lowest 30 percent of the nutrition score distribution, scoring values to maximal 48), *desirable* (upper 30 percent of the distribution, scoring values of 58 or more) and *intermediate* (middle 40 percent of the nutrition score). Information on the nutrient intake of the Rhenen population enabled us to make a rough estimate of the nutrient composition for various values of the nutrition score. For the 'undesirable' and 'desirable' food consumption patterns, the average nutrient composition is presented in table 4. Due to the classification of the subjects on the basis of a composite score, adjacent ranges in average nutrient composition appear for some single nutrients.

### Results

The selection and intake frequency of food products is depicted in table 1. In this table the food products are arranged in accordance with the Netherlands Food Composition Table (16). Those food products that have been used to construct the nutrition score are given a figure in parentheses. This figure represents the nutrient for which we consider the product as indicative, of course some of the choices may be arbitrary.

The distribution of the nutrition score that illustrates the food

Figure 1. Comparison of the distributions of the nutrition score computed from 7-days record data (Rhenen population, n=100) and diet history recall data (study population, n=1951)



**Table 3. Comparison of classification according to the actual nutrient intake with the nutrition score/composite nutrient scores of subjects in the Rhenen population**

Spearman rank correlation coefficient ( $r_s$ )	
Score	$r_s$ +
Overall nutrition	0.58
Fat	0.50
Polyunsaturated fat	0.25
Simple carbohydrates	0.44
Cholesterol	0.63
Dietary fibre	0.39
Alcohol	0.85

+ all  $r_s$  significant at  $\alpha = 0.05$

**Table 4. Estimated average nutrient composition of the 'desirable' and 'undesirable' food consumption pattern related to the criteria of a prudent diet**

Nutrient	Prudent diet	'Undesirable'	'Desirable'
Fat (energy %)	30 - 35	40 - 46	35 - 40
Polyunsaturated fat (en %)	10 - 12	5 - 8	8 - 10
Carbohydrates (en %)	53 - 60	40 - 47	53 - 60
Cholesterol (mg/day)	<250	350 - 450	250 - 300
Dietary fibre (g/4.2 kJ)	11 - 15	7 - 8	9 - 11
Alcohol (energy %)	+	$\geq 7$	$\leq 5$
Salt (g/day)	3 - 5	++	++

+ no recommendation : 4 or more consumptions/day ( $\geq 7$  energy%) endangers health

++ no information available

consumption pattern for the study population and the cut-off points for the 'undesirable' and 'desirable' group are given in figure 2. The male-female ratio in the 'undesirable' category is 1.5 (60% men and 40% women), in the 'desirable' category it is 0.4 (31% men and 69% women). Especially young men reveal inadequate dietary habits. The picture shows that only about 4% of the study population exceeds the value that coincides with the recommendations of a prudent diet.

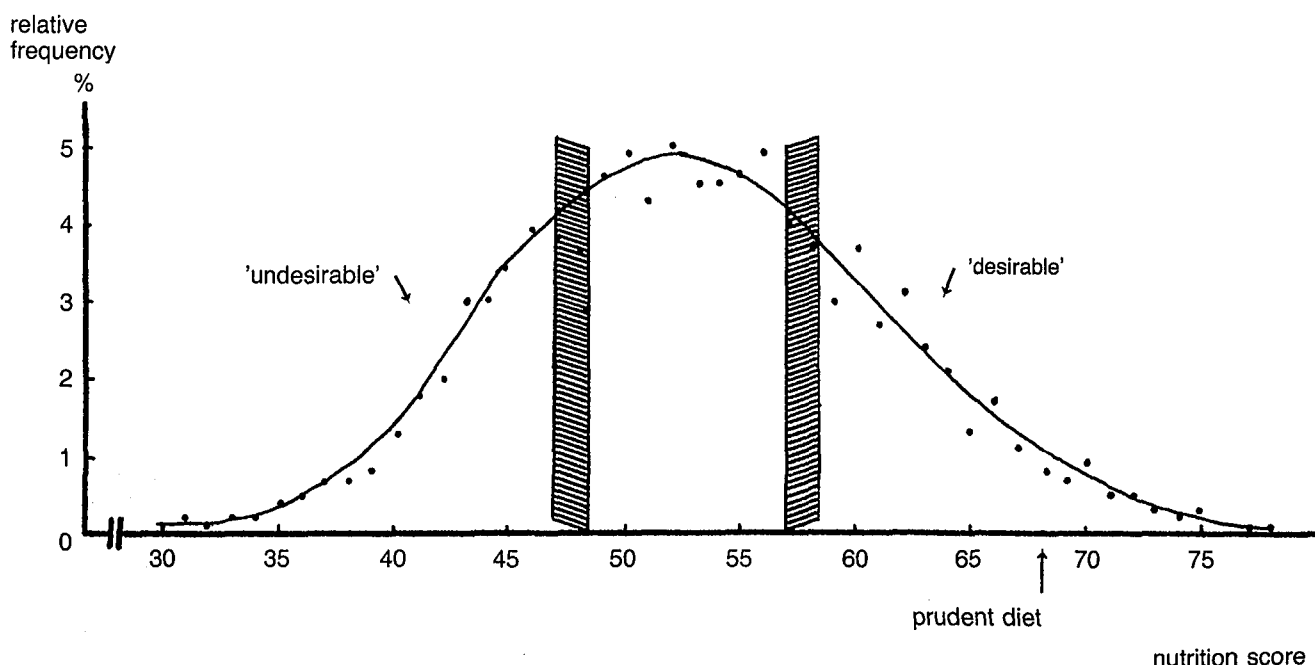
The selection and intake frequency of food products included in the nutrition score are presented for 'undesirable' and 'desirable' food consumption patterns in table 5. The food products are listed under the heading of the nutrient they represent. Compared to the 'undesirable' category, there is a general change to a more favourable food selection and consumption in the group with 'desirable' dietary patterns: more low fat and vegetable products and less animal foods, single carbohydrates etc. See for instance under the heading polyunsaturated fats the discrepancies in every day usage of butter and margarine, or under dietary fibre the brown and white bread consumption.

### Discussion

In this article results of a study of the quality of the food consumption pattern of the Dutch adult population are presented. Data on this subject were collected by personal interview of a random sample ( $n=1951$ ) of the Dutch population.

The questionnaire is based on food products common in the Dutch diet. Because our main interest was in the cardiovascular area we focussed on products contributing to

**Figure 2. Cut-off points for 'undesirable' and 'desirable' food consumption patterns in the distribution of the nutrition score of the study population ( $n=1951$ )**



**Table 5. Listing of food products included in the questionnaire to construct the nutrition score. Selection and intake frequency of food products for 'undesirable' (P<sub>30</sub>) (n=578) and 'desirable' (P<sub>70</sub>) (n=568) food consumption patterns**

Nutrient	Weekly consumption												
	every day		5 or 6 day		3 or 4 day		1 or 2 day		<1 day		never		
	P <sub>30</sub>	P <sub>70</sub>	P <sub>30</sub>	P <sub>70</sub>	P <sub>30</sub>	P <sub>70</sub>	P <sub>30</sub>	P <sub>70</sub>	P <sub>30</sub>	P <sub>70</sub>	P <sub>30</sub>	P <sub>70</sub>	
	%	%	%	%	%	%	%	%	%	%	%	%	
<b>Fat</b>													<b>Vet</b>
yoghurt (whole milk)	8	4	6	2	15	6	30	8	—	—	41	81	gewone yoghurt
yogurt (skimmed milk)	2	20	1	8	6	12	11	19	—	—	80	42	magere yoghurt
cheese (40 <sup>+</sup> )	55	38	10	7	15	17	15	16	—	—	5	23	gewone kaas
cheese (20 <sup>+</sup> )	2	15	1	3	1	6	3	7	—	—	93	70	magere kaas
minced meat					3	1	67	42	24	36	6	20	gehakt
smoked sausage (cooked) or pork sausage	1				1		45	17	42	47	11	36	rookworst of verse worst
bacon (fat, fresh)					1		25	10	41	28	33	63	speklappen
cutlet	1		1		10	4	59	39	23	24	6	23	karbonade
salty biscuits or potato crisps	3		1		11	1	39	13	28	36	18	49	zoutjes of chips
peanuts or other nuts	2	1	1		7	1	36	14	32	37	22	47	pinda's of andere nootjes
croquettes or minced meat balls					2		32	3	41	26	25	71	croquetten of frikadellen
potato chips or French fries					2		40	6	43	32	15	62	patat frites
<b>Polyunsaturated fats</b>													<b>Meervoudig onverzadigde vetzuren</b>
margarine	44	8	2	1	2		1	1	—	—	51	91	gewone margarine
halvarine (40% fat)	29	38	2	1	1		1	1	—	—	67	60	halvarine
dietmargarine (> 60% pufa)	6	32		2		1	1	1	—	—	93	64	dietmargarine
butter	16	9	3	1	3	1	13	6	—	—	65	84	roomboter
shortening/cooking oil (see Other foodproducts)													spijsvet/-olie (zie Overige)
<b>Simple carbohydrates</b>													<b>Enkelvoudige koolhydraten</b>
custard or porridge	17	4	5	1	21	4	32	23	13	20	12	48	vla of pudding
desserts (industrial prepared)	1	1			2		16	5	21	13	60	81	kant-en-klaar toetjes
fruits in syrup for or at dessert	1	1			3	1	20	9	39	28	37	61	vruchten op sap
biscuits	3	1	1		9	2	32	14	23	23	32	61	grote koeken
cakes, tartes or pastries	2	1			5	2	39	23	41	51	13	23	gebak of cake
softdrinks (see Beverages)													frisdranken (zie Dranken)
fruitjuice (see Beverages)													vruchtesap (zie Dranken)
white sugar (see Other Food products)													witte suiker (zie Overige)
<b>Cholesterol</b>													<b>Cholesterol</b>
liver or kidney	1				1		7	5	39	28	52	67	lever of niertjes
eggs (see Other food products)													eieren (zie Overige)
<b>Dietary fibre</b>													<b>Voedingsvezel</b>
brown bread	39	62	6	4	12	6	8	3	—	—	35	25	bruinbrood
white bread	45	7	4	2	10	4	17	11	—	—	24	77	witbrood
whole wheat bread	14	28	2	3	6	7	14	11	—	—	64	52	volkorenbrood
fruit (see Other food products)													fruit (zie Overige)
<b>Alcohol (see Beverages)</b>													<b>Alcohol (zie Dranken)</b>

		daily consumption																	
		>5		5		4		3		2		1		<1		0			
		P <sub>30</sub> P <sub>70</sub>		P <sub>30</sub> P <sub>70</sub>		P <sub>30</sub> P <sub>70</sub>		P <sub>30</sub> P <sub>70</sub>		P <sub>30</sub> P <sub>70</sub>		P <sub>30</sub> P <sub>70</sub>		P <sub>30</sub> P <sub>70</sub>		P <sub>30</sub> P <sub>30</sub>			
		%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%		
<b>Beverages</b>																		<b>Dranken</b>	
-non alcoholic:																		-niet alcoholisch:	
glasses of whole milk		1		1		2		5	1	12	4	24	8	12	4	43	83	glazen volle melk	
glasses of low fat milk								2	3	3	8	6	14	4	6	85	69	glazen halfvolle melk	
glasses of skimmed milk										1	2	1	6	1	4	97	87	glazen magere melk	
glasses of buttermilk								1	2	3	5	6	13	15	19	75	59	glazen karnemelk	
glasses of softdrinks		1		1				4	1	10	1	26	9	34	31	24	58	glazen frisdrank	
glasses of fruitjuice						1		1	1	2	3	16	13	31	34	49	48	glazen vruchtessap	
-alcoholic:																		-alcoholisch:	
glasses of beer		5		1		2		7	1	6	1	10	3	23	17	46	77	glazen bier	
glasses of sherry, port								1	2	2	3	3	8	22	25	72	63	glazen sherry, port	
glasses of wine								1	1	2	2	3	7	34	36	60	54	glazen wijn	
spirits						1		2	1	5	3	9	4	25	21	58	70	borrels	
<b>Other food products</b>																		<b>Overige</b>	
use of shortening/cooking oil																		gebruik van spijsvet/-olie	
																		take bake or to fry	
																		P <sub>30</sub> P <sub>70</sub>	
																		% %	
																		2 21	
																		94 67	
																		3 8	
																		1 4	
oils																			
shortenings																			
combination shortenings/oils																			
no shortenings/oils																			
sugar use																		suikergebruik	
amount of spoonfuls in:																			
																		>3 3 2½ 2 1½ 1 ½ 0	
																		% % % % % % % %	
coffee	P <sub>30</sub>																	7 32 8 32 3 18	
	P <sub>70</sub>																	5 1 13 6 72	
tea	P <sub>30</sub>																	4 26 5 30 4 31	
	P <sub>70</sub>																	4 1 13 6 76	
egg use																		eierengebruik	
amount of visible, non-processed eggs at one week																			
																		>7 7 6 5 4 3 2 1 <1 0	
																		% % % % % % % % % %	
	P <sub>30</sub>																	6 4 3 8 12 22 26 12 5 2	
	P <sub>70</sub>																	1 3 9 33 27 16 10	
fruit use																		fruitgebruik	
																		daily consumption	
																		>4 4 3 2 1 <1 0	
																		% % % % % % %	
	P <sub>30</sub>																	1 1 4 24 39 21 10	
	P <sub>70</sub>																	3 5 20 35 26 7 4	

- : not asked  
blank: less than 0,5%

the fat and simple carbohydrate intake; in addition the cholesterol and polyunsaturated fat consumption were ascertained. Less attention was paid to dietary fibre and alcohol; no information was obtained about the protein and salt content of the diet. Investigation of salt consumption by dietary surveys is difficult.

The value of this study largely depends on the method used to establish the food consumption pattern. Inherent to a

qualitative method is the lack of quantitative data. It is questionable whether one can get a reasonable impression of an individual's diet by inquiring only after the food consumption frequency.

To meet this difficulty, information was gathered on those food products that are the main sources of the nutrients we were interested in. For instance in the Dutch diet the average daily fat intake is mainly derived from meat, margarine/cook-



ing oils or shortenings and dairy products (14, 17). So with the chosen products in the questionnaire we approximately covered half of the average daily fat intake. Analogously for polyunsaturated fats about half of the daily consumption, for simple carbohydrates and cholesterol about one third, for dietary fibre about 40% and for alcohol almost the total daily intake (14,17).

The nutrition score represents an overall image of the preventive value of the diet, with special focus on fats and simple carbohydrates. We have to bear in mind the perhaps theoretical concept that an individual, who is 'wrong' on one particular nutrient (heavy drinker), can be classified in the 'desirable' group.

Application of our questionnaire to quantitative data obtained by seven days recording in the Rhenen population supports the assumption that our method is useful for evaluation purposes in nutrition education, because it supplies information that is indicative for the preventive value of diets of groups.

In view of the objectives of health education – gradual changes towards healthy behavior – together with the recent controversies concerning dietary recommendations (10) the criteria for a healthy food pattern in this study are in many aspects less extreme than those of a prudent diet (table 4). Therefore the terminology is 'desirable' food consumption pattern, shifting in a direction of a preventive diet. But even then our cut-off points are arbitrary. Even so, adherence to dietary recommendations is not yet common practice in the Dutch population. An estimated 4% of our study population meets the standards of a prudent diet (figure 2).

In health education terms a slight average change in behavior of a large group is already considered a positive effect. Despite our findings of low adherence to a preventive diet in this prevalence study, gradual changes have been noticed in the Dutch nutritional behavior. Comparisons of per capita food consumption data mutually (2, 3) with our data (table 1) show that beside some negative trends in recent decades, e.g. decreasing bread and potato intake, positive trends can also be recognized in the Dutch population. The amount of wholewheat bread increased as well as the consumption of low fat milk and other low fat dairy products. For instance low fat yogurt and buttermilk became more popular while sugar, butter and eggs seemed to become less attractive. About ten years after the introduction of halvarine (40% fat) and dietmargarine ( $\geq 60\%$  polyunsaturated fats) an important part of the population uses these products daily. The increasing meat consumption (10% rise in per capita gross consumption from 1977 to 1979) (3) remains a problem, because of its probable contribution to the intake of invisible fats. Similar trends in food consumption patterns have been noticed in the United States (6).

## Samenvatting

### Voedselconsumptiepatroon van de Nederlandse bevolking in 1978

Bij een aselechte steekproef van 1951 volwassen Nederlanders is in

1978 het voedselconsumptiepatroon vastgesteld. Hierbij is via een kwalitatieve vraagmethode informatie verzameld over de frequentie waarin bepaalde voedingsmiddelen doorgaans worden geconsumeerd. De methode is vooraf getest op kwantitatieve gegevens, afkomstig van een zevendaagse voedingsanamnese. Om een preventieve waarde toe te kunnen kennen aan het individuele voedingspatroon is een scoringsstelsel ontwikkeld, gebaseerd op de nutriëntensamenstelling van een 'prudente' voeding. Op deze wijze is voor elk persoon in het onderzoek een zogenaamde 'voedingscore', die het individuele voedingspatroon typeert, berekend.

In Nederland blijkt slechts een gering deel van de volwassen bevolking (circa 4%) te voldoen aan de criteria van een prudente voeding.

De gebruikte vraagmethode lijkt geschikt voor evaluatiedoeleinden in voedingsvoorlichtingsprogramma's.

## Acknowledgement

This study was financed by the Netherlands Heart Foundation (grant no. 24.001) and carried out under the supervision of the Department of Human Nutrition (Head: Prof. dr. J. G. A. J. HAUTVAST) and the Department of Extension Education (Head: Prof. dr. ir. A. W. VAN DEN BAN) of the Agricultural University, Wageningen. The authors owe many thanks to dr. E. DEKKER, Medical Director Netherlands Heart Foundation, to J. P. VANDENBROUCKE, epidemiologist, Department of Epidemiology Erasmus University Rotterdam, and to W. A. VAN STAVEREN, nutritionist, Department of Human Nutrition, Agricultural University, Wageningen for their helpful suggestions on the manuscript.

## References

1. **American Heart Association Committee on Nutrition.** Diet and coronary heart disease (committee report 1977-1978). *Circulation* **58** (1978), 762.
2. **Bosman, W.:** De voeding in Nederland in 1976. *Voeding* **40** (1979), 351.
3. **Centraal Bureau Statistiek.** Statistisch zakboek. Staatsuitgeverij. 's-Gravenhage 1980.
4. **Dietary goals for the United States.** Select Committee on Nutrition and Human Needs. US Senate. Uitg. US Government Printing Office. Washington, DC, 1977.
5. **Farrand, E. M. and L. Mojonier:** Nutrition in the Multiple Risk Factor Intervention Trial. (MRFIT). *J. Amer. diet. Ass.* **76** (1980), 347.
6. **Friend, B., L. Page and R. Martson:** Food consumption patterns in the United States 1909-13 to 1976. In: **R. Levy, B. Rifkind, B. Dennis and N. Ernst** (eds): Nutrition, lipids and coronary heart disease. Uitg. Raven Press. New York 1979, p. 489-522.
7. **Heyrman, J. M. K.:** Screening van voedingsgewoonten door de huisarts. Proefschrift. Leuven 1975.
8. **Keys, A.:** Dietary survey methods. In: **R. Levy, B. Rifkind, B. Dennis and N. Ernst** (eds): Nutrition, lipids and coronary heart disease. Uitg. Raven Press. New York 1979, p. 1-23.
9. **Kok, F. J.:** Kennis, houding en gedrag van de Nederlandse bevolking van 18 t/m 64 jaar ten aanzien van exogene risicofactoren voor het hartinfarct. Rapport Vakgroep Humane Voeding, Landbouwhogeschool. Wageningen 1978. *Voeding* **40** (1979), 134.
10. **McNutt, K.:** Dietary advice to the public: 1957 to 1980. Special Report. *Nutr. Rev.* **38** (1980), 353.
11. **Rommel, P. S. and R. C. Benfari:** Assessing dietary adherence in the Multiple Risk Factor Intervention Trial (MRFIT) II. Food record rating as an indicator of compliance. *J. Amer. diet. Ass.* **76** (1980), 357.
12. **Rommel, P. S., D. D. Gorder, Y. Hall and J. L. Tillotson:** Assessing dietary adherence in the Multiple Risk Factor Intervention Trial (MRFIT) I. Use of a dietary monitoring tool. *J. Amer. diet. Ass.* **76** (1980), 351.
13. **Siegel, S.:** Non parametric statistics for the behavioral sciences. Uitg. McGraw-Hill Kogakusha, Ltd. Japan 1956. p. 202-213.

14. **Staveren, W. A. van:** Kan voedingsvezel van een categorie volwassen Nederlanders bepaald worden? *Voeding* 40 (1979), 113.
15. **Truett, J., J. Cornfield and W. Kannel:** A multivariate analysis of the risk of coronary heart disease in Framingham. *J. chron. Dis.* 20 (1967), 511.

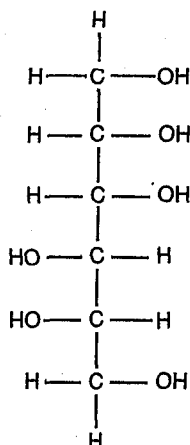
16. **Voorlichtingsbureau voor de Voeding.** Nederlandse Voedingsmiddelentabel, aanbevolen hoeveelheden energie en voedingsstoffen. 31e druk. 's-Gravenhage 1978.
17. **Wijn, J. F. de:** Wat kan voeding bijdragen tot de primaire preventie van atherosclerotische aandoeningen? *Ned. T. Geneesk.* 119 (1975), 492.

## Metabole gevolgen van het gebruik van polyalcoholen en fructose – literatuurstudie\*

### Deel 4 – Mannitol

#### 4.1. Enige fysische en chemische eigenschappen

De structuurformule van mannitol:



Het is een stereoisomeer van sorbitol. Mannitol is een witte kristallijne stof met een molgewicht van 182,17. De zoetkracht van mannitol is ongeveer gelijk aan die van sorbitol en is vastgesteld op 0,45 in vergelijking met saccharose (2). Mannitol komt in een aantal groentes voor, zoals andijvie, uien, kool en selderij. De hoeveelheid, die hierin aanwezig is, varieert van 40-400 mg/100 gram. Selderij bevat zelfs 4 gram mannitol/100 gram (20). Ook olijven en bepaalde bomen bevatten mannitol (8). De productie van mannitol geschiedt door elektrolytische reductie van glucose (8). Het wordt in de voedselindustrie toegepast in technologische processen, o.a. als vochtstabilisator en verdikkingsmiddel. Bovendien wordt het gebruikt als vervangende zoetstof in speciale dieetprodukten (8,22).

De energetische waarde van mannitol is door STAUB (19) bij ratten bepaald d.m.v. een groeioproef. Gerelateerd aan de groei van deze dieren onder invloed van saccharose, bepaalde hij voor mannitol een energetische waarde van 11,3 kJ/gram (2,7 kcal/gram). ELLIS e.a. (4) berichten reeds dat

door Mw. Ir. W. A. M. VAN DER WIEL-WETZELS

5% mannitol in het voer van ratten tot een verminderde groei leidde in vergelijking met glucose. DWIVEDI (2) vermeldt dat de energetische waarde van mannitol op ongeveer 8,4 kJ/gram (2 kcal/gram) is vastgesteld.

#### 4.2. Absorptie van mannitol

Er is verondersteld dat mannitol niet geabsorbeerd zou worden (FORDTRAN e.a.), maar de meeste studies spreken dit tegen. Zo vermeldt EARL GINN (3) in een overzicht van mannitol, dat in 1883 reeds absorptie van mannitol is aangetoond bij de hond. In 1938 verrichtten CARR e.a. studies met ratten, waaruit bleek dat van een 15% mannitol-oplossing ± 90% geabsorbeerd was.

RUTLOFF e.a. (18) vermelden dat er geen getallen voorhanden zijn voor de absorptie van mannitol. Om dit te onderzoeken brachten zij ± 250 mg mannitol in de darm van de rat en constateerden na 30 minuten dat 10% van deze dosis geabsorbeerd was. Hierbij werden zowel de darminhoud als een homogenaat van de darm geanalyseerd. Voor glucose werd onder gelijke omstandigheden een absorptie van 22% gevonden. In de vena porta was mannitol aantoonbaar.

Ook HINDLE e.a. (13) konden absorptie van mannitol aantonen bij de hond. Zowel in het duodenum als in het ileum werd mannitol weliswaar traag, maar in aanzienlijke hoeveelheden geabsorbeerd.

NASRALLAH e.a. (15) voerden een studie uit met proefpersonen die doses gelabeld mannitol, variërend van 28-100 gram, opnamen na één nacht vasten. Gemiddeld 31% van deze doses werd onveranderd teruggevonden in de faeces. De excretie van mannitol in de faeces vond vrijwel uitsluitend de eerste dag plaats. Na 3 dagen kon geen mannitol meer in de faeces worden aangetoond. Indien diarree optrad ten gevolge van een dosis mannitol werd significant meer mannitol in de faeces uitgescheiden (gemiddeld 42%). De auteurs spreken van een 'aanzienlijke absorptie'. Men vermoedt aan de hand van de radioactiviteit, gemeten in het bloed, dat de absorptie van mannitol voornamelijk plaatsvindt in de middelste en onderste delen van de darm. LAUNIALA (14) vermeldt dat de aanwezigheid van mannitol in de darm tot een versnelde passagetijd leidt door de aantrekkingskracht van water.

Over het transportmechanisme van mannitol is niets be-

\* Uitgevoerd in opdracht van de Commissie Suikervervangende Stoffen in Levensmiddelen van de Voedingsraad.