Turku sugar studies VI

The administration of the trial and the control of the dietary regimen

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125 voluntary subjects, divided into three groups, were originally chosen to participate in a two-year trial in which the dental and general effects of the consumption of sucrose (S 35), fructose (F 38) and xylitol (X 52) were elucidated through an extensive clinico-chemical analysis plan. Additionally 2 edentulous subjects were included in the X-group for survey of the general metabolic effects only. The subjects were given free of charge a versatile assortment of foodstuffs sweetened with either S, F or X. Using special distribution and control systems, the subjects were handled and controlled so that an almost comparable consumption of the products was achieved throughout the trial. The mean individual monthly intake of S, F and X was 2.2, 2.1 and 1.5 kg, respectively. The highest daily amounts of S, F and X per person varied between 200—400 g. The cooperation of the subjects completing the study in the F- and X-groups was 97 %, expressed as the intake frequency of the correct sugar. Ten persons discontinued or were otherwise excluded for a diversity of reasons. No health problems were observed, except for transient osmotic diarrhoea in the X-group. These symptoms gradually disappeared and occurred later in the trial in the X-group almost to the same extent as in the S- and F-groups.

Key-words: Sucrose; fructose; xylitol; nutrition

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The background of the Turku sugar studies is found in reports showing marked differences between various natural sugars regarding their breakdown products, cariogenicity in animal experiments, and variations in the physical properties and chemical composition of plaque and saliva. Other important factors were non-toxicity, existence of normal metabolic pathways, and available facilities for the production of considerable amounts of fructose and xylitol for human use (*Aminoff*, 1974).

The present studies were planned to provide information about the effect of a strict sucrose, fructose and xylitol diet on dental and general health in human subjects. The present paper describes the practical arrangement of the trial, with special reference to the control and management of the diet, the cooperation of the subjects and the occurrence of subjectively experienced side effects.

GENERAL ADMINISTRATION

Initiation

Following short-term studies on the effects of xylitol and fructose (*Scheinin & Mäkinen*, 1971, 1972; *Mäkinen & Scheinin*, 1971, 1972) plans were developed to elucidate the effects of these two sugars

on the incidence of dental caries, and the dental and oral conditions in general, as thoroughly as possible in a long-term trial. Almost one year, 1971 to 1972, was used to develop the planning and organization of the Turku sugar studies, which in addition to evaluation of the caries activity also comprised *i.a.* biochemical and microbiological studies in plaque and saliva, and monitoring of the general health of the participants through blood and urine tests. Simultaneously a versatile dietary regimen to be followed by the subjects for two years, was developed.

Selection of the subjects

At the planning stage of the study due consideration was given to the ethical aspects involved, particularly in keeping human subjects on a potentially cariogenic diet. For this reason the sugar intake involved was planned not to exceed the habitual consumption of the subjects. Considerable variation in the dosage and frequency of intake was thus anticipated.

In view of the duration of the trial, the extent of cooperation required of the subjects, and the stress caused by a multitude of registrations and tests, the concept of participation was from the very beginning completely based on voluntariness. Institutionalized persons were not included in the study, because the aim of the trial was to show the effects of the consumption of the various sugars in normal and healthy subjects. An endemic population was also rejected, because most of the assays could only be organized close to the present research laboratories. At the planning phase the most difficult aspects in the trial were considered to be as follows:

— Cooperation with regard to the diet
— Adequate recording of the individual consumption of the foodstuffs
— Objective recording of the state of health during the trial
— Willingness to be submitted to a series of tests for monitoring the general health conditions

Information about the forthcoming long-term trial was first given to dental and medical students, laboratory and other personnel at the Institute, as well as members of their families and other persons being in contact with the activities of the dental school. The general characteristics of the trial were fully described to the above persons, who in turn forwarded the information to other mutually interested persons. The final 127 subjects were selected among hundreds of persons after a general information occasion.

In view of the motivation and the general requirements it was clear that the best subjects were obtained from dental students and other persons related to the activities of the dental school. Because all products were distributed free of charge, any apparent willingness for participation on economical basis only was considered a reason for rejection. The most common motive for participation was seen to be an interest in the own health, and the evident significance of the trial.

In view of the cooperation of the subjects being absolutely essential, the subjects were offered a possibility to belong to a specific sugar group according to individual preference. About one half of the participants used this opportunity, the other half being distributed at random into the sugar groups. Subsequently all subjects were informed of the group they belonged to, a double blind study being considered out of question. Certain minor differences with regard to taste, appearance and texture of the various products, although being almost identical in the three sugar groups, would otherwise soon

have provided the information. Moreover, it was found necessary to label the products to prevent errors in their distribution to occur.

The following list includes a number of other details considered at the planning and realisation of the study:

1. Pregnancy was not considered to prevent participation.
2. The subjects were asked to refrain from all fluoride prophylactics during the test.
3. The subjects were otherwise asked to take care of their oral hygiene measures and dental treatment exactly as earlier.
4. The subjects were advised to arrange their summer vacation and traveling exactly as under normal conditions.
5. The subjects were requested not to change their dietary habits.

Prior to the start of the dietary regimen all subjects were interviewed by completing a questionnaire. In this way the dietary habits of the subjects and other points of interest were clarified.

In a number of cases whole families participated in the trial. In these situations it was preferred to arrange all family members to consume the same sugar. This was considered to minimize the risk of the intake of the wrong sweetener. There was one family comprising five, one family comprising three and several families comprising two members on the same sugar diet. In two cases the test persons of the same family were put to consume different sugars. This was due to the initial state of the dental health; in general, subjects with a high caries incidence were not accepted to the S-group.

On the basis of the above information it was natural that many of the recommendations for a controlled clinical trial could not be taken into account, the essential guiding factors being the ethical aspects regarding the human experimental material and the desired level of cooperation of the subjects with regard to the selective sugar diets during period of two years.

The subjects

Table I lists the subjects with regard to sex, age, sugar group, duration of participation, months of pregnancies, weight, length, wrist-girth and family relationship, all as recorded at the end of the trial. In a few cases the sugar group was changed during the trial, as indicated by an asterisk in the table. These subjects (Tables I & II) were omitted in all calculations of the incidence of dental caries from the moment of a change of group. Table I further shows the profession of the subjects, and their sugar intake during the trial, the latter observations being presented separately in this paper. The heading »Family relationship» indicates which subjects belonged to the same family. The family members are indicated by giving in each case the number of all other members occurring elsewhere in the list (Table I).

All subjects had the possibility to refrain from participation at any time. During the study, only 10 subjects discontinued for various reasons, or were otherwise excluded (Tables I & II). In the sucrose group there were no problems in adhering to the diet. Due to rampant caries, a married couple (No. 125 & 126) was, however, transferred to the xylitol group. Similarly, one subject (No. 29) in the fructose group was transferred to the xylitol group, these transfers not being considered in the presentation of the final results. The remaining cases were due to difficulties in adhering to the strict dietary regimen, other personal reasons, and weak

Table II. *List of discontinued, excluded or transferred subjects*

No	Initial sugar group (Months after start)	Discontinued (D), excluded (E) or transferred (T)	Reason for interruption or change
29	F (12)	T***	Rampant caries
85	F (12)	D	Satiety with regard to participation (no health problems)
89	X (12)	D	As above (the subject additionally explained that her pregnancy would affect participation)
103	X (11)	D	The subject had a history of allergic skin reactions; this was considered restrictive with regard to continuation (otherwise no health problems)
104	X (5)	D	As for 85 (additional difficulties due to employment)
109	F (12)	D	As for 85
113*)	X (24)	E	Weak cooperation
115**)	X (2)	D	Persisting osmotic diarrhoea; finally even very low amounts of xylitol led to slight diarrhoea (possibly for psychological reasons)
125	S (18)	T***	Rampant caries
126	S (18)	T***	As above

*) The subject completely gave up xylitol consumption as well as all subsequent sugar intake, and was consequently not included in the present calculations. The lack of cooperation was revealed after processing of the data sheets.

**) The subject discontinued at an early phase of the trial, and was replaced by No. 127, who was involved in the xylitol group for approximately 22 months.

***) The subjects were transferred to the xylitol group.

cooperation (Table II). The present report is thus based on 117 subjects, 33 of these belonging to the S-group, 35 to the F-group, and 49 to the X-group.

Subject No. 42*) was furthermore excluded in the report dealing with the general effects of the diets (*Huttunen, Mäkinen & Scheinin*, 1975). In addition, the two edentulous subjects, Nos. 123 and 124, were for obvious reasons not included in the reports covering the dental and periodontal findings (*Scheinin, Mäkinen & Ylitalo*, 1975; *Paunio, Mäkinen & Scheinin*, 1975).

The initial estimate was that approximately 25 % of the subjects would cease from participation at some stage of the trial, particularly in the xylitol group. As shown in Table II, the loss of subjects was surprisingly low. This was partially due to the wide assortment of products and the service provided throughout the trial.

*) Subject No. 42 in the xylitol group was diabetic, the disease being detected in 1961. Blood glucose level exceeded 8 mmol/l. Treatment: Injections of 2.2 ml insulin per day. Patient in poor condition before trial. Subjectively considerable improvement due to the use of xylitol, the consumption being 65 g/day. The subject had a special liking for sweets; diabetes has earlier prevented the consumption of these products. The subject was under medical supervision during the sugar study.

Table III. *List of products available at the distribution center*

Product		Content of either sucrose, fructose, or xylitol (in weight per cent)*)
A. *Pastry*		
1. Viennese rolls	Of varying appearance and containing varying fillings	8.0 (6.0)
2. Sweet rolls and buns		10.0 (8.0)
3. Sweet loaves		8.0
4. Doughnuts (filled with jam)		13.0 (11.0)
5. Sweet biscuits (two different types)		18.0 – 21.3
6. Jam-filled short cakes, pies, etc. (orange, apple, strawberry, etc.) (altogether 8—10 different types)		10.0 – 22.0
7. Waffles (strawberry, lemon, banana)		33.1
8. Miscellaneous cakes, (4-5 different types)		20.0 – 24.0
9. Muffinses		18.0 (15.0)
10. Chocolate cake		30.0
11. Various national dishes		10.0 22.0
The assortment of pastry ranged from 30 to 35 in each sugar group during the two-year trial.		
B. *Confectionery*		
1. Chocolate bars and slaps (4—5 different flavours)		30.0 – 43.0 (28.0 – 30.0)
2. Chocolate-covered candy marmelade		45.0 (42.0)
3. Lozenges (gum pastilles; three different flavours)		33.0 – 58.5
4. Gum pastilles, liquorice		40.0
5. Candies (four different types and flavours)		43.0 – 100.0
6. Chocolate with jam-fillings		43.0 (30.0)
7. Chewing gum (3 different types)		49.0 – 74.0
C. *Jams, marmelades and juices*		
1. Orange marmelade		60.0
2. Apple marmelade		60.0
3. Strawberry jam		50.0
4. Red whortleberry jam		50.0
5. Concentrated orange juice (orange squash)		50.0 (45.0)
6. Concentrated black currant juice (black currant squash)		53.0 (43.0)
7. Soft drinks (including several types containing lemon, orange, grape fruit; coca cola and a still drink)		10.0 – 11.0 (5.2 – 7.2)
D. *Canned products*		
1. Cucumber (sliced or whole)		2.4
2. Red beet		21.5
3. Pumpkin (squash)		19.8
4. Cucumber relish		5.0
5. Herring (spiced with tomato souce, wine souce, etc.; altogether five different brands)		48.0
E. *Other products*		
1. Tomato ketchup		17.5 (11.7)
2. Mustard		21.0 (14.0)
3. Ice cream (three different flavours)		12.0
4. Cough mixture		60.0
5. Tonic containing iron, liver and vitamins		30.0
F. *Sugar in consumer packages*		100.0

*) Due to the high sweetness of fructose, some products contained less fructose than sucrose or xylitol. These values of fructose are given in parenthesis.

ORDER FORM GROUP: sucrose fructose xylitol (underline) Date ___/___ 197___
The order form is to be left at the delivery center.

NAME:_____

SUGAR	packages	CHOCOLATE	bars	REFRESHING DRINKS	bottl.
LENGTHY ROLLS	pieces	LOZENGES	boxes	ICE CREAM	l
SWEET ROLLS	pieces	CHEWING GUM	pieces	HERRING	jars
WIENER BREADS	pieces			CANNED CUCUMBER	jars
MUFFINS (xylitol)	pieces			CANNED PUMPKIN	jars
				CANNED BEETROOT	jars
		RED WHORTLEB.JAM.	jars	MUSTARD	tubes
WAFFLES	packages	STRAWBERRY JAM	jars	KETCHUP	jars
BISCUITS	packages	ORANGE MARMELADE	jars		
		ORANGE JUICE	bottles		
		BLACK CURRANT J.	bottles		

Important: Please do not alter your eating habbits from before.

Fig. 1. The order form used by the subjects on each visit to the distribution center. Because the assortment was bigger than indicated in the form, empty places were used to designate other products received.

Characteristics of the diets

Attempts to arrange the diet as versatile as possible were undertaken. The main principles in planning of the dietary regimen were as follows:

— As far as possible, similar products with regard to appearance, texture and composition were manufactured.
— In the F- and S-groups the dietary regimen in its whole extent started October 1972. In the X-group the regimen began simultaneously, but the start was progressive; the assortment of products was increased gradually within three or four weeks to reach the level in the other groups. The exact number of days of participation with regard to each subject was known. In a few cases the duration was 720—725 days, but in the great majority of cases the dietary regimen was extended to 730—745 days.
— In the course of the trial the assortment of products was gradually expanded. Within one year a maximum level, remaining approximately constant during the second year, was achieved.
— The S-products, also given free of charge, comprised only the assortment available in the two other groups.
— All subjects were asked to avoid the consumption of noticeably sweet fruits (dried figs, raisins and dates), because these could not be used in the F- and X-groups.

Altogether 12 different food and other factories in Finland were manufacturing all the products used in the study. Development and planning of the products took place prior to the trial and during its course. Pastry was obtained thrice a week from a local bakery.

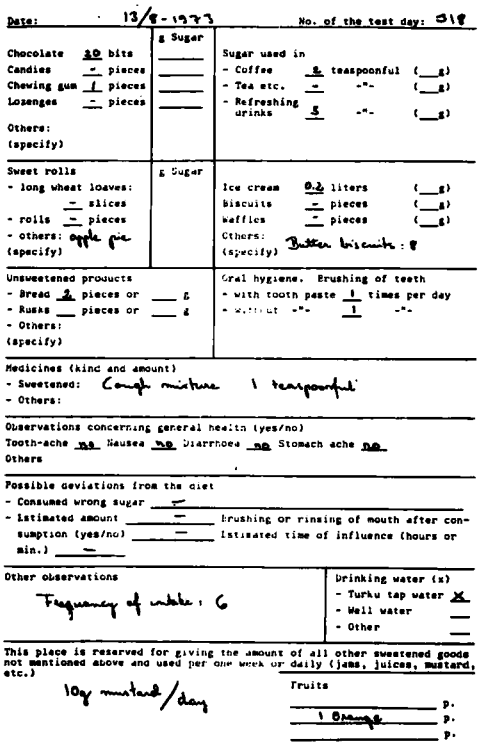
Table III gives a list of the products together with information of their sugar content. Problems were encountered in connection with the manufacture of some of the special products. Most fructose products were possible to make by simple replacement of sucrose. In certain cases the pronounced sweetness of fructose necessitated a lowering of its content. The consumption of sucrose and fructose was, however, almost equal (Fig. 4).

The fructose products were generally considered equal, and in some cases, particularly in jams, marmalades, juices and pastry, superior to the sucrose-containing products.

For xylitol the initial situation was more complicated at the beginning of the trial. This was partly due to lack of experience in making xylitol-containing products. Due to the chemical structure of xylitol, it was not attacked by ordinary yeast cells in making dough. Furthermore, its somewhat lower solubility (168 g/100 ml water at 0° C) when compared to sucrose (199 g/100 ml at 0° C), evoked problems with regard to the manufacture of some of the products. In certain pastry bicarbonate

was used to rise the dough. Practically all technological problems were solved, however, in the course of the study. The more ready crystallization of xylitol when compared to sucrose caused its occasional recrystallization in a few products (orange and apple marmalade). Keeping the marmalade jar in warm water until dissolution of the crystals, and storing the jars well closed, was sufficient to control the phenomen and the recrystallization did not affect other qualities of the product. There was some hardening of lozenges which could have been controlled with softeners. In the present studies it was, however, required that the lozenges and other related products should contain only one specified sugar.

In some cases, for example, ice cream, chocolate, certain pastry and some canned products, the quality and taste of the xylitol products exceeded those of the ordinary sucrose-containing ones. In general, these products were of a very high quality. It was thus generally not possible to differ between the xylitol- and sucrose-containing products, as also clearly in-


Date: 13/9-1973 No. of the test day: 3\8

	g Sugar	
Chocolate 10 bits		Sugar used in
Candies - pieces		- Coffee 5 teaspoonful (g)
Chewing gum 1 pieces		- Tea etc. - -"- (g)
Lozenges - pieces		- Refreshing urinks 5 -"- (g)
Others: (specify)		
Sweet rolls	g Sugar	
- long wheat loaves: - slices		Ice cream 0.2 liters (g)
- rolls - pieces		Biscuits - pieces (g)
- others: apple pie (specify)		Waffles - pieces (g)
		Others: Butter biscuits : 9 (specify)

Unsweetened products
- Bread 2 pieces or g
- Rusks pieces or g
- Others: (specify)

Oral hygiene. Brushing of teeth
- with tooth paste 1 times per day
- without -"- 1 -"-

Medicines (kind and amount)
- Sweetened: Cough mixture 1 teaspoonful
- Others:

Observations concerning general health (yes/no)
Tooth-ache no Nausea no Diarrhoea no Stomach ache no
Others

Possible deviations from the diet
- Consumed wrong sugar -
- Estimated amount - Brushing or rinsing of mouth after consumption (yes/no) - Estimated time of influence (hours or min.) -

Other observations: Frequency of intake : 6

Drinking water (x)
- Turku tap water X
- Well water
- Other

This place is reserved for giving the amount of all other sweetened goods not mentioned above and used per one week or daily (jams, juices, mustard, etc.)
10g mustard/day

Fruits
p.
1 Orange p.
p.

Fig. 2. An example of a filled page on the diary of a subject belonging to the xylitol group. When evaluating the daily consumption of the sugar involved, the amount of sugar in all the products indicated on each page was taken into account. In obscure cases the subject involved was requested to provide a more detailed description on the diet and amounts taken in.

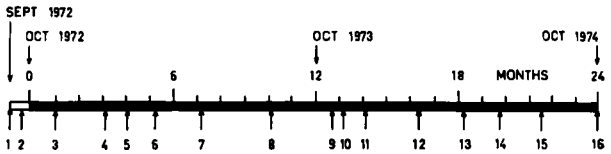


Fig. 3. The overall schedule of the study. The arrows and numbers below the line stand for the following examinations:

1 = First main determination of clinical, radiographical, chemical and microbiological base line values of caries, saliva and plaque. The first collection of blood samples (afternoon values) and urine (24 hours).
2 = Clinical duplicate examination.
3 = Determination of certain plaque microbiological values.
4 = Second main determination of clinical, chemical, and microbiological values of plaque and saliva.
5 = Clinical duplicate examination. First sample collecting for the microbiological study in Würzburg.
6 = Second collection of blood samples (afternoon values) and 24-hour urine.
7 = Third main clinical, radiographical, chemical, and microbiological studies of caries, saliva and plaque.
8 = Third collection of blood samples (fast values).
9 = Fourth main clinical, radiographical, chemical, and microbiological study of caries, saliva and plaque. First periodontal study. Collection of gingival crevice fluid.
10 = Second sample collection for the microbiological study in Würzburg.
11 = Sugar tolerance test including other blood analyses (fourth blood sample collection).

12 = Collection of saliva for peroxidase and redox potential measurements, as well as for a more detailed invertase study. Collection of gingival crevice fluid for peroxidase assays.
13 = Fifth collection of blood samples (fast values) and 24-hour urine.
14 = Fifth main clinical, radiographical, chemical, and microbiological study of caries, saliva, and plaque. Third sample collection for the microbiological study in Würzburg.
15 = Terminating (6th) collection of blood samples (afternoon values).
16 = Terminating (6th) clinical, radiographical, chemical, and microbiological studies of caries, plaque and saliva. Second and final periodontal study with collection of gingival crevice fluid. Fourth sample collection for the microbiological study in Würzburg.

It is to be noted that the arrows stand for the beginning of each 2—4 weeks sample collection.

dicated by the consumption of the sugars (Table I, Fig. 4).

Use of the distribution center

Usually the center was open thrice a week. The individual order forms (Fig. 1) were later used for control purposes through comparison with the figures appearing in the diaries. In general, facilities provided by the distribution center were not abused. The subjects were allowed to introduce the products to other persons.

Control of the diet

All subjects were given a 750-page diary, divided into three volumes (Fig. 2). The 24-month trial was thus in some of the calculations divided into three eight month phases. Due to experience obtained during the study the diary was gradually improved.

The diaries were examined after each eight-month period. The exact amount of sugars in each product was known by the investigators. Because the test persons were advised to complete the diary in a predetermined way, the calculations of the daily, weekly, monthly and annual intake of sugar, as well as the frequency of sugar intake, were routine, but time-consuming measures (Tables I & V—VII, Fig.4). These calculations were accompanied by interviews in case of difficulties in the assessment. Any deviation from the dietary regimen was requested to be mentioned in the diary (Fig. 2). An estimate of the own health condition was also asked to be mentioned. In addition, the personal contact between the subjects and the first author (K. K. M.) who knew the sugar group, was of utmost importance with regard to successful cooperation.

Enhancement of cooperation

The cooperation of the subjects was enhanced through various measures, *i.e.* through the arrangement of informative

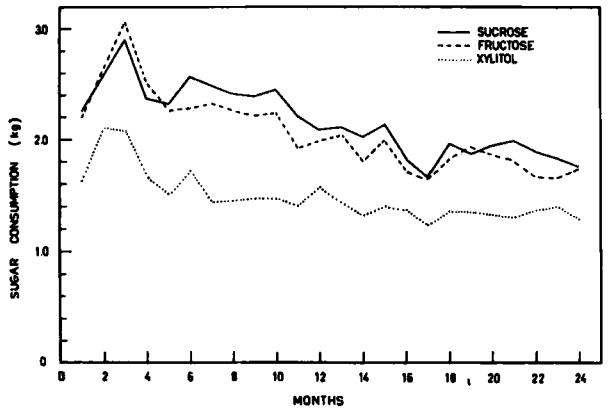


Fig. 4. The overall consumption of sucrose, fructose and xylitol during the two-year study. Note that the values comprise only that sugar given for use from the distribution center.

Table IV. *Overall schedule of the two-year Turku sugar trial. For the sake of readability, the Table does not include detailed information on various types of samples of oral origin, which were studied. Consequently, the term »salivary» stands in this overall schedule for saliva, plaque, or their composite fractions. Table I of paper No VII in this series gives a detailed description*

Analysis or registration	Paper	Approximate point of performance (months)															
		—1	0	1	3.5	4.5	5.5	7.5	10.5	13	13.5	14	16.5	18.5	20	22	24
Clinical registration (caries)	I, V	×	×		×	×		×		×					×		×
Radiographical » »	I, V	×			×			×		×					×		×
Periodontal registration	IX									×							×
Plaque index	II, VII	×			×			×		×					×		×
Gingival index	IX									×							×
Plaque fresh weight	II, VII	×			×			×		×					×		×
Weight of test persons	VI	×			×			×		×					×		×
Length of test persons	VI											×					
Wrist girth of test persons	VI											×					
Salivary pH	VII	×			×			×		×					×		×
» protein	VII	×			×			×		×					×		×
» total nitrogen	VII	×			×			×		×					×		×
» total sugars	VII	×			×			×		×					×		×
» hydroxyproline	VII, XIV																×
» RNA and DNA	VII	×			×			×		×					×		×
» total keto acids	VII	×			×			×		×					×		×
» pyruvate	VII	×			×			×		×					×		×
» lactate	II, VII							×		×					×		×
» Na, K, Ca, Mg	VII																×
Salivary F^-, I^-, SCN^-	XII																×
» glycosidases	XVII,VII	×			×			×		×			×				×
» transaminases	VII	×			×			×		×					×		×
» lactate and xylitol dehydrogenases	VII	×			×			×		×					×		×
» alcohol dehydrogenase	VII									×							×
» collagenase	VII	×			×			×		×					×		×
» other proteinases	VII												×		×		×
» aminopeptidases	VII	×			×			×		×					×		×
» invertase	II, VII	×			×			×		×			×		×		×
» dextranase	II, VII	×			×			×		×					×		×
» aldolase	VII	×			×			×		×					×		×
» amylase	VII																×
» peroxidase	XII							×		×							×
» catalase	XII																×
» amino acid composition	XIV							×		×					×		×
» sialic acid	VII							×		×			×		×		×
Salivary pH	VII, XII	×			×			×		×			×		×		×
» Eh	XII												×				×
» APB-like enzymes	VII																×

(Cont.)

(Cont.)

Analysis or registration		Paper	Approximate point of performance (months) —1	0	1	3.5	4.5	5.5	7.5	10.5	13	13.5	14	16.5	18.5	20	22	24
Exudate arg. aminopeptidases		XV									×							×
		IX																
» protein		IX									×							
» peroxidases		XII												×				
» hydroxyproline		IX																×
Serum cholesterol	Not fasted persons	XI	×					×									×	
» triglyserides		XI	×					×									×	
» glucose		XI	×					×									×	
» uric acid		XI	×					×		×			×		×		×	
» transaminases		XIII						×									×	
» lactate		XI						×									×	
» pyruvate		XI						×									×	
» lactate dehydrogenase		XIII						×									×	
Hemoglobin		XIII						×									×	
Leukocytes		XIII						×									×	
Sedimentation velocity		XIII						×									×	
Urine uric acid (24 hour urine)		XI	×					×							×			
Serum cholesterol	Fasted persons	XI								×			×		×			
» triglyserides		XI								×			×		×			
» glucose		XI								×			×		×			
» uric acid		XI								×			×		×			
» insulin		XI											×					
» transaminases		XIII								×					×			
» lactate		XI								×					×			
» pyruvate		XI								×					×			
» lactate dehydrogenase		XIII								×					×			
» hemoglobin		XIII								×					×			
Leukocytes		XIII								×					×			
Sedimentation velocity		XIII								×					×			
Sugar toleration test		XI											×					
Serum bilirubin	Either or not fasted persons	XIII													×		×	
» alkaline phosphatase		XIII															×	
» acid phosphatase		XIII													×		×	
» ascorbic acid		XIII										×						
» amylase		XIII															×	
» Na		XIII															×	
» K		XIII															×	
» Ca		XIII															×	
» Mg		XIII															×	
» amino acid analyses		XIII										×			×		×	
» phosphorus (inorganic)		XIII															×	

(Cont.)

(Cont.)

Analysis or registration	Paper	Approximate point of performance (months) —1	0	1	3.5	4.5	5.5	7.5	10.5	13	13.5	14	16.5	18.5	20	22	24
Microbiology:																	
Saliva, McConcey	VIII	×			×			×		×					×		×
» Lactobacillus (LBS agar)	VIII	×		×	×			×		×					×		×
» Sabouraud	VIII	×		×	×			×		×					×		×
» tellurite, aerobes	VIII	×								×							×
» tellurite, anaerobes	VIII	×															×
» blood, aerobes	VIII	×															×
» blood, anaerobes	VIII	×															×
» McLeod, aerobes	VIII	×															×
» McLeod, anaerobes	VIII	×															×
Plaque, blood, aerobes	VIII	×		×													×
» blood, anaerobes	VIII	×		×													×
» McLeod, aerobes	VIII	×		×													×
» McLeod, anaerobes	VIII	×		×													×
Saliva, tellurite, aerobes	VIII	×			×					×					×		×
» tellurite, anaerobes	VIII	×															×
» N-Agar	VIII																×
Detailed study on polysaccharide-forming streptococci and acid-formation tests	III, X					×				×					×		×

sessions and social gatherings, provision of printed and verbal information, and a number of special transportation and distribution services.

Overall schedule of the 2-year trial

Fig. 3 shows the overall schedule of the present studies, the two year period being evenly covered by different registrations sample collections and tests. A more detailed description of all the separate phases is provided in Table IV which gives practically all the separate analyses and inspections carried out.

OBSERVATIONS ON THE CONSUMPTION, COOPERATION AND SUBJECTIVE SIDE EFFECTS

Consumption of the various sugars

Table I shows the individual consumption of the various sugars, calculated per month and for the total period. The frequency of sugar intake, expressed as the mean daily value during the last eight months of the study, is also shown. The consumption, calculated on the basis of diaries kept by the subjects, does not include »hidden» sugars contained in various products generally available, i.e. sausages, various ready-made products, etc. Consequently, all values relative to sugar consumption, were lower than the average annual intake, c:a 45 kg/person/year, of ordinary consumers in Finland indicates.

As expected, the use of sugar increased suddenly at the early phases of the trial in all sugar groups. The free of charge distribution, the available of new products, and curiosity apparently led to an increased sugar consumption.

As shown in Fig. 4, the monthly intake of sugar began to decrease after Christmas

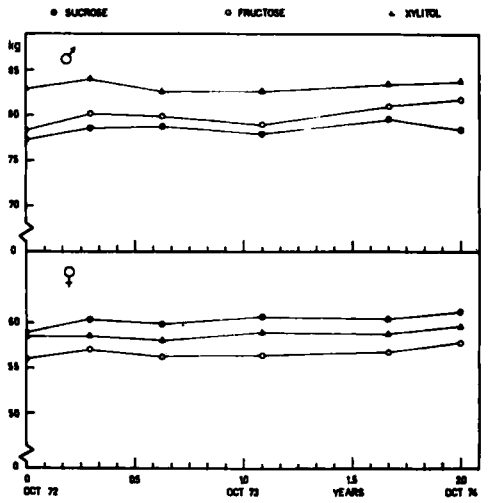


Fig. 5. The weight of the test persons (see text).

1972. During the second and third eight-month phase the consumption of sugars diminished as shown in Table V, which also indicates the percentage change as compared to the preceding phase. In the third eight-month phase the rate of decrease was slower in the F- and X-groups than in the S-group.

The differences between the amounts of sugar consumed during the first 16 months was considered to have been due to initial difficulties in producing a comprehensive assortment of xylitol-containing products, and also fear of getting an osmotic diarrhoea, particularly as the subjects were informed of the eventual side effects and asked to report even slight symptoms.

Cooperation

During the trial it was found essential to estimate to level of dietary cooperation of the subjects through relatively simple

Table V. *Changes in sugar consumption during three successive 8-month phases (I, II and III)*

Phase	I	II		III	
	Intake in kg	Intake in kg	Change %	Intake in kg	Change %
Sucrose	19.9	17.3	—13.1	14.9	—13.9
Fructose	19.8	16.1	—18.7	14.1	—12.4
Xylitol	13.7	11.4	—16.8	10.6	— 7.0

Table VI. *The average number of deviations and total sugar intake during three successive 8-month phases (I, II and III)*

Phase	Sucrose		Fructose		Xylitol	
	Total	Per subject and month	Total	Per subject and month	Total	Per subject and month
I	100	0.4	1200	4.0	1500	3.5
II	110	0.4	1200	4.0	1400	3.5
III	160	0.6	1100	4.0	1000	2.5
Total (I+II+III)	370	0.5	3500	4.0	3900	3.2
Total intake of sweetened products	115000	145	113000	135	129000	110
Average cooperation %		99.7*)		97		97

*) The difference from 100 was mainly due to subjects No. 107 and 77 who used a commercial sorbitol-containing chewing gum (186 and 50 pieces, respectively).

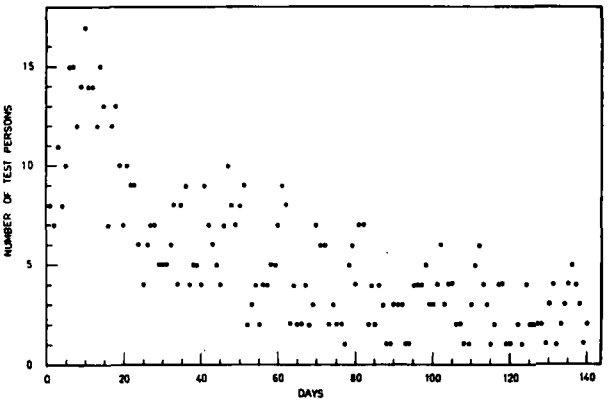


Fig. 6. An illustration showing the lessening of the laxative and gas-forming effects of xylitol. The ordinate gives the number of test persons complaining even about slight diarrhoea or increased defecation frequency on each test day. Information as to the rest of the study is shown in Tables VII & VIII.

means. The diaries of the subjects were used for this purpose, although the participants were not told about the procedure. On the contrary, the subjects were informed that aberrations from the diet were to be expected for natural reasons, and that all these deviations should be reported for honestly.

On the basis of intake frequency of the correct and wrong sugars, percentual cooperation coefficient was developed. All products listed in Table III, added by several ones not mentioned, f.ex. figs, raisins, etc., were taken into account. In these calculations a single dose or repeated consumption of sweetened products not exceeding a 30 min period, was used to stand for one separate intake. A cooperation coefficient of 98 % thus indicates that there were 2 deviations of a total of 100 intakes. This type of individual cooperation was common, as indicated by Table I. In addition Table VI shows the average number of deviations, expressed in terms of the intake frequency of a wrong sugar and the total intake of sweetened products.

The cooperation coefficients shown in Tables I and VI require the following clarification. The coefficients may appear unexpectedly high. It should be noted, however, that the coefficients for the whole groups cover only those subjects who completed the trial. Table I indicates all persons excluded in the calculations. The participation of these subjects was, however, otherwise considered until discontinuation or exclusion.

Weight of the subjects

Fig. 5 shows the development of the weight of the subjects, pregnant, excluded, discontinued or transferred cases not being included. The six youngest and clearly adolescent participants (No. 37, 58, 83, 84, 100, 102) were also not included.

Subjective side effects

Xylitol was well tolerated by the majority of the subjects. The highest daily amount of xylitol taken in by one test person (No. 47) exceeded 430 g. In this situation no diarrhoea or other harmful effects were observed, although this occurred at other occasions in this subject. In the course of the study numerous cases were recorded where the daily consumption clearly increased 200 g which has been considered as an exceptionally high dose (*Dubach et al.*, 1969). Table VII lists in terms of study days, the consumption of xylitol or fructose in exceptionally high amounts in the 35 subjects in the X-group and 22

Table VII. *Number of study days involving substantial consumption of xylitol or fructose, and occurrence of diarrhoea-like symptoms during three successive 8-month phases (I, II & III) in these subjects*

	Number of days with an intake of			Total	Frequency of diarrhoea per subject and month		
	100—149 g	150—199 g	≥200 g		I	II	III
Xylitol (n = 35)	1416	230	64	1710	2.7	1.1	0.7
Fructose (n = 22)	1982	434	117	2533	0.3	0.1	0.1

Table VIII. *The occurrence (in number of cases) of diarrhoea-like conditions and flatulence in the subjects during three successive 8-month phases (I, II, and III)*

Phase	Sucrose		Fructose		Xylitol	
	Total	Per subject and month	Total	Per subject and month	Total	Per subject and month
I	120	0.38	125	0.38	980	2.25
II	100	0.38	85	0.25	390	0.88
III	90	0.38	100	0.38	210	0.50
Total study	310	0.38	310	0.34	1580	1.21

in the F-group. It also shows the occurrence of diarrhoea-like symptoms during three successive 8-month phases in the same subjects. It should also be noted that several subjects did not experience any symptoms although they in some cases deliberately attempted to cause a laxative effect, by consuming pure xylitol 60 g as a single dose. It was also noted that a 200 g daily dose of xylitol caused diarrhoea-like conditions on some days, whereas the same and much higher doses led to no symptoms on other days. The subjects may have exaggerated the symptoms in some cases, because they were informed to observe even slight symptoms relative to the laxative effect and occurrence of flatulence.

Examination of Table VII further shows that the occurrence of diarrhoea dimished throughout the study. This is also evident when examining the total material (Table VIII, Fig. 6) with regard to the frequency of diarrhoea-like symptoms and flatulence during the three successive 8-month phases. Fig. 6 shows that lessening of the laxative effect took place gradually within the first weeks. After 140 days the effect still continued to decrease, but it did not disappear totally during the study in the case of some subjects (Table VIII). The reported laxative effects were reduced to one fourth when comparing the first 8-month phase to the third. It is, however, not known to what extent the subject were governed by subjectivity in the xylitol group, all being avare of the possible laxative properties of high dosage of xylitol.

DISCUSSION

The present human trial differs from the previous Vipeholm study (*Gustafsson et al.*, 1958) in several details. For example, in the latter institutionalized subjects on specified diets with regard to intake

frequency and dosage of sucrose, were investigated. In the present trial the material consists on voluntary subjects on unspecified diets with regard to intake frequency and dosage, but strict relative to specified sugars.

The Turku sugar studies certainly comprise a selected material, particularly with regard to the large number of dental students involved. The age distribution of the subjects may be considered another weakness, particularly from the main aspect of study of the incidence of dental caries where the selection of a young, homogenous age group would have been advantageous.

The imperfections of the trial include further the possibility offered to the subjects to belong to a specified sugar group, leading thus to the absence of a fully randomized experimental material and a single blind study approach.

Consequently, many of the recommendations presented by *Glass* (1968), for example, about the design of clinical studies of dental caries, could not be closely followed. The suggestions presented by *Nizel* (1972) on certain practical measures were partially followed.

The weaknesses of the trial further include the unrealistic approach aiming at a total substitution of sucrose through fructose or xylitol.

It should, however, be considered that the present sugar diets were maintained particularly in order to monitor the general health and the occurrence of eventual side effects in the subjects under the prevailing strict dietary conditions. In addition, the deviations from an ideal clinical trial were particularly considered in view of ethical aspects and the extent of cooperation required of the subjects during the 2-year trial.

The solidity of the present long-term studies may rest in the general arrangement, the clinical and radiographic findings, independently assessed, being supplemented through versatile biochemical and microbiological analyses. Considerable information is also obtained through monitoring of the sugar diets and the subjective side effects, as reported for in the present paper and the reports on the general health of the subjects and participants.

The present findings show that the consumption of F- and S-containing products was almost identical, the consumption in the X-group being somewhat lower than in the two other groups. The individual consumption which served as a basis for further evalutions, is thought to be meticulously assessed. The findings indicate that the sugar consumption was lower than the average annual figures would indicate. On the other hand, »hidden» sugars contained in various common commercial products are not included. The cooperation of the subjects, was estimated through an index developed for the purpose. The cooperation of the subjects, with exceptance of the relatively few discontinued or excluded cases, can in general be considered highly satisfactory. The evaluation of eventual subjectively experienced side effects during the study reveals that diarrhoea-like symptoms and flatulence were the main complaint. The laxative effect of the diet was noticeable particularly during the early phases of the study in a number of subjects in the X-group. A closer analysis of these cases shows that during the last 8-month phase of the trial, the occurrence of diarrhoea-like symptoms was practically equal in the three sugar groups. The subjects in the X-group might initially have overrecorded their symptoms, being alerted through information given by the investigators

about the laxative effects of this particular sugar. The adaptation to tolerate xylitol seems to be gradual.

The present studies further verify the observations of *Mosinger* (1971) and *Banziger* (1970), that a dose of 100 mg xylitol per kg body weight per day, or a dosage of 200 g per day (*Dubach et al.*, 1969), can be tolerated. The findings show that xylitol can be tolerated at even higher levels. This conclusion concerns enteral administration in man, and no conclusions are drawn regarding parenteral administration or experimental animals.

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APPENDIX

Table I. *Description of the subjects with regard to sex, age, profession, duration of participation, months of pregnancies, weight, height, wrist-girth and family relationship recorded at the end of the trial. The table also shows the sugar group, the monthly and total intake of the respective sugars, the frequency of the sugar intake per day (see text), and the cooperation coefficient (see text)*

No.	Sex	Age	Sugar	Participation (months)	Months of pregnancies	Weight (kg)	Length (cm)	Wrist-girth (cm)	Family relationship	Cooperat. coeff.	Profession
1	f	36	S	24	—	64.5	176	17.5	—	100	Lab. technician
2	f	27	F	24	9	58.0	168	15.2	—	96	Lab. technician
3	f	34	F	24	—	61.5	165	15.3	—	97	Lab. technician
4	f	33	F	24	—	53.5	155	15.5	53	99	Lab. technician
5	f	25	F	24	—	52.0	168	14.3	—	98	Lab. technician
6	f	33	S	24	—	60.0	169	16.5	—	100	Lab. technician
7	f	29	S	24	7	64.0	163	15.0	14	100	Lab. technician
8	f	29	X	24	15	60.0	166	16.0	12	98	Lab. technician
9	f	36	S	24	—	58.0	164	14.8	—	100	Lab. technician
10	f	40	X	24	—	60.0	162	15.4	101, 100	98	Lab. technician
11	m	24	F	24	—	68.0	171	17.4	23	100	Lab. technician
12	m	30	X	24	—	69.0	183	16.3	8	99	Photographer
13	m	44	X	24	—	80.0	173	19.3	58	99	Carpenter
14	m	28	S	24	—	79.0	173	17.5	7	100	Student
15	m	25	F	24	—	61.0	171	16.0	19	99	Lab. technician
16	m	46	S	24	—	103.0	179	21.6	—	100	Technician
17	f	33	F	24	—	62.0	163	16.2	61	96	Secretary
18	f	25	X	24	—	60.5	158	15.4	—	97	Dent. student
19	f	21	F	24	—	46.0	155	15.0	15	100	Housewife
20	m	25	X	24	—	84.0	182	18.6	—	98	Dent. student
21	f	33	X	24	—	62.0	166	14.9	—	99	Dent. student
22	f	24	X	24	3	58.0	168	16.0	115	95	Dent. student
23	f	26	F	24	—	57.0	169	14.8	11	100	Housewife
24	f	24	X	24	—	50.5	165	14.2	—	96	Dent. student
25	f	34	F	24	—	64.0	170	15.7	—	95	Dent. assistant
26	f	23	X	24	—	54.0	162	14.0	—	94	Dent. student
27	m	24	S	24	—	67.0	185	15.9	39	100	Dent. student
28	f	24	F	24	—	63.0	166	15.8	—	88	Dent. student
29	f	34	F	24	—	51.0	165	15.1	—	98	Dent. assistant
30	f	24	X	24	—	76.0	181	16.4	—	93	Dent. student
31	m	24	X	24	—	82.0	180	17.6	—	98	Dent. student
32	f	29	F	24	9	49.0	163	14.4	33	97	Housewife
33	m	27	F	24	—	85.0	184	18.0	32	99	Dent. student
34	m	26	F	24	—	88.0	186	17.3	36	92	Med. student
35	m	24	F	24	—	66.0	171	16.1	—	96	Dent. student
36	f	24	F	24	9	59.0	163	15.0	34	91	Dent. student
37	f	19	F	24	—	56.0	171	15.0	—	98	College student
38	m	27	S	24	—	57.0	174	15.3	—	100	Dent. student
39	f	27	S	24	9	46.0	160	14.7	27	100	Nurse
40	f	23	X	24	—	60.5	170	16.6	94	91	Dent. student
41	f	36	S	24	—	55.0	161	16.3	—	100	Lab. technician
42	f	30	X	24	—	57.5	166	16.3	—	97	Dental assistant
43	f	25	F	24	—	52.0	162	14.7	—	93	Dent. student
44	f	27	X	24	—	52.0	167	14.3	—	100	Dent. student
45	f	37	X	24	—	59.0	158	15.1	93	98	Dental assistant

Monthly intake of sugar (kg)																									
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Total	Freq.
3.9	3.8	4.6	3.2	3.0	3.1	3.3	2.9	3.2	3.6	3.3	3.1	3.8	3.2	3.5	2.8	3.0	2.3	3.4	2.8	3.5	3.5	3.1	2.8	78.7	6
2.0	3.1	2.8	2.2	2.6	3.2	2.6	2.6	2.8	2.0	2.4	0.9	1.6	1.9	1.9	1.9	1.6	1.5	1.9	1.5	1.4	1.8	1.7	2.1	50.0	3
1.4	1.9	2.3	1.8	1.6	1.5	1.7	1.6	2.1	2.0	1.5	1.5	1.6	1.3	2.3	1.6	1.6	1.2	1.5	1.6	1.7	2.0	1.7	1.9	40.9	4
2.7	1.9	2.4	2.0	1.9	1.9	2.5	2.1	1.5	1.3	1.1	1.9	2.0	1.6	1.4	1.4	1.1	1.8	1.6	3.1	2.6	1.9	1.7	2.9	47.3	4
1.3	2.0	1.4	1.9	2.1	0.5	1.2	1.8	1.3	1.1	1.1	1.1	1.1	0.7	0.9	1.2	0.8	1.0	1.6	1.4	1.6	1.6	1.5	2.2	32.4	4
2.0	1.8	2.1	1.8	1.8	2.4	2.6	2.1	3.0	3.7	3.6	2.1	2.3	2.1	2.0	1.8	1.8	1.4	1.5	1.2	1.9	1.8	1.0	1.3	49.1	3
3.2	3.8	4.4	3.3	2.8	4.4	4.4	3.8	3.1	2.9	2.6	2.4	2.1	1.7	2.2	2.2	2.1	2.6	2.7	2.3	2.9	3.2	2.8	2.5	70.4	4
1.0	0.8	1.2	1.2	1.2	0.8	0.5	0.8	0.8	0.6	0.9	0.7	0.9	1.1	0.7	0.8	0.4	0.9	1.2	1.3	0.7	0.7	0.7	0.5	20.4	3
1.5	1.8	2.0	1.6	1.8	2.0	2.5	2.7	3.8	3.3	3.0	2.3	2.5	2.6	3.9	3.8	2.5	3.4	3.6	3.1	3.2	3.2	2.6	3.9	66.6	6
2.7	2.4	2.8	2.3	2.4	2.9	2.9	2.5	2.3	2.1	2.2	2.3	1.6	1.3	1.8	1.8	2.6	2.0	2.3	2.0	1.1	1.8	2.6	2.1	52.8	4
3.5	4.2	5.0	2.7	1.8	1.4	1.1	2.6	0.9	1.7	1.1	0.8	0.5	0.4	2.0	0.4	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	35.7	5
1.7	2.8	2.7	2.2	2.4	3.4	3.4	2.5	1.9	1.2	0.9	1.2	1.0	1.0	1.0	0.7	0.8	1.3	1.7	1.8	0.7	1.0	1.7	1.2	40.2	4
3.3	5.3	4.0	3.4	2.8	3.2	1.8	0.7	1.8	2.3	2.6	2.2	4.0	1.9	1.8	2.3	1.1	1.4	1.3	1.4	1.0	1.4	1.4	1.2	53.6	5
3.1	2.6	2.4	3.1	3.2	3.2	3.2	2.9	3.1	3.2	2.1	2.3	2.3	1.4	2.0	1.8	2.6	2.4	3.1	2.9	2.9	3.0	2.4	1.7	62.9	5
3.5	4.5	6.1	6.0	5.8	6.2	5.8	6.3	5.6	3.8	4.5	5.4	5.5	5.4	5.1	5.5	4.3	5.0	5.2	5.4	4.8	5.4	5.5	5.3	125.9	6
4.8	4.6	4.9	4.3	4.1	6.5	3.6	6.2	6.8	9.4	5.5	6.8	5.1	5.6	4.5	4.8	4.1	5.7	4.0	5.2	5.9	3.1	4.7	3.7	123.9	4
1.9	2.3	3.4	2.3	1.6	2.4	2.0	1.8	2.5	2.6	1.6	2.1	1.8	1.1	1.4	1.0	1.0	0.7	0.8	0.6	0.9	0.6	1.0	0.9	38.3	4
1.1	1.5	0.7	1.0	1.1	1.3	0.8	1.1	1.1	0.9	1.5	1.1	1.0	1.0	0.9	0.8	0.4	0.5	0.8	0.8	0.7	0.8	1.1	1.2	23.2	4
3.1	2.9	3.9	3.5	3.3	3.2	3.2	3.3	3.9	4.6	3.9	4.4	4.5	4.5	5.3	4.2	3.9	3.7	3.7	3.9	3.9	3.5	3.9	3.3	91.5	4
0.8	1.0	1.8	1.4	0.9	0.7	0.8	1.0	0.8	0.4	0.8	0.8	0.4	0.7	0.8	1.0	1.1	1.0	1.0	0.8	0.4	0.8	1.4	0.8	21.4	3
0.7	1.2	0.8	0.8	0.7	0.1	0.2	0.6	1.3	0.5	0.1	0.7	0.5	0.8	0.2	0.6	0.2	0.4	1.0	0.2	0.3	0.4	0.7	0.7	13.7	1
1.0	1.5	1.5	1.1	1.3	1.1	0.8	1.2	1.8	1.0	1.7	1.4	1.3	0.9	0.7	0.8	1.2	0.8	0.6	0.8	1.6	1.2	0.6	0.7	26.6	4
1.7	1.7	2.3	2.0	1.9	2.0	1.3	1.0	1.5	3.0	0.9	1.3	0.6	0.6	1.0	1.5	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	33.1	6
1.0	1.2	1.2	0.8	1.1	1.1	0.9	0.9	0.7	0.7	0.7	1.1	0.7	0.7	0.8	0.7	0.5	0.4	0.8	0.5	0.4	0.3	0.5	0.4	18.1	3
3.2	3.6	4.6	4.0	3.9	4.4	4.6	3.7	4.2	4.6	4.0	4.0	4.0	3.7	3.9	3.6	3.1	3.3	3.2	3.3	3.1	3.9	3.7	4.0	91.6	5
1.9	2.2	1.8	2.1	1.4	1.6	0.9	1.1	1.7	0.7	0.7	2.1	1.0	1.0	1.0	1.5	1.0	1.0	1.0	1.2	1.0	0.7	1.2	1.2	31.0	4
1.0	0.7	1.0	0.9	0.5	0.6	0.6	0.6	0.9	0.7	0.6	0.5	0.5	0.6	0.6	0.3	0.2	0.3	0.2	0.2	0.2	0.2	0.2	0.2	12.3	4
1.5	1.7	1.5	1.0	0.9	0.4	0.9	0.4	0.7	0.4	0.3	0.6	0.7	0.4	0.6	0.5	—	1.5	1.9	0.9	0.7	0.2	0.2	1.1	19.0	2
2.9	5.1	6.5	5.4	3.9	5.8	4.5	5.1	6.3	6.7	6.0	0.5				cf. Table II. Not included in calculations									58.7	6
1.1	1.5	1.4	0.8	1.1	0.9	0.5	0.4	0.8	0.7	0.5	0.6	0.7	0.5	0.6	0.7	0.5	0.4	0.5	0.7	0.4	0.4	—	0.3	16.0	3
1.7	2.1	2.0	2.4	2.0	1.8	2.0	2.2	1.8	2.2	1.7	2.8	2.6	2.1	2.0	2.5	1.8	1.7	1.8	1.6	1.8	1.9	1.7	1.5	47.7	4
1.7	2.4	2.0	2.3	2.3	1.5	1.5	1.5	1.0	1.4	1.6	1.6	1.6	1.5	1.2	1.5	1.4	1.3	1.9	1.7	1.7	1.9	1.9	1.7	40.1	4
2.6	2.9	3.0	2.9	2.4	2.3	2.4	2.3	1.3	1.4	2.3	2.2	2.0	1.9	1.4	1.2	1.2	1.1	1.6	1.4	1.5	1.9	2.3	1.9	47.4	3
3.1	4.7	3.5	1.9	2.1	1.7	2.4	1.3	2.4	2.2	1.8	1.7	1.3	1.7	1.8	1.7	0.6	1.4	1.0	1.6	1.4	1.1	1.0	0.7	44.1	3
3.3	3.0	3.2	1.8	2.2	2.2	2.2	1.8	2.5	3.6	1.8	2.4	1.6	1.6	1.6	1.2	1.4	1.5	1.1	1.8	1.8	1.4	2.6	1.7	49.3	4
2.0	2.7	3.9	3.0	1.9	1.5	3.7	1.5	2.3	1.6	2.4	1.8	2.8	1.8	1.0	0.7	1.3	1.5	1.1	1.5	0.8	1.8	1.3	1.3	45.2	3
1.5	3.7	1.7	2.0	1.3	1.7	2.4	2.2	1.5	1.3	1.2	1.4	1.3	1.5	1.4	0.7	0.6	0.9	0.6	0.5	0.2	0.7	1.8	1.3	33.4	3
3.2	3.0	3.4	2.7	4.3	2.1	2.9	3.5	3.0	2.7	2.5	3.1	3.1	3.4	4.2	2.4	2.3	3.1	2.6	3.0	2.7	2.7	2.5	2.9	71.3	7
1.4	1.5	1.8	1.6	1.2	1.5	1.4	1.2	1.2	0.9	0.9	1.6	1.5	1.4	1.0	0.8	1.5	2.0	2.0	1.5	1.4	1.2	0.7	0.6	31.8	4
2.6	4.1	3.2	1.8	1.9	2.6	2.0	1.2	1.4	1.5	0.8	1.6	1.5	0.8	1.6	0.7	0.5	0.4	0.6	0.6	0.8	0.8	2.3	2.2	37.5	3
4.6	3.9	5.0	4.0	4.5	4.4	4.4	3.1	6.1	5.9	3.1	4.1	3.7	3.1	4.1	3.2	2.6	3.3	2.8	4.9	4.8	4.2	3.8	3.9	97.5	8
2.2	2.7	2.6	1.7	1.6	2.7	2.5	2.8	2.0	1.8	2.5	2.4	2.4	2.3	1.9	1.8	1.7	1.9	1.7	1.7	0.8	0.9	1.0	1.6	47.2	6
1.0	1.2	2.0	1.3	1.4	0.9	1.0	1.0	0.9	1.2	1.0	1.4	1.1	1.5	1.2	1.4	1.1	1.3	0.9	1.0	1.0	1.0	0.9	1.1	27.8	3
1.0	1.1	1.4	0.8	0.7	0.7	0.6	0.8	0.8	1.0	0.6	0.8	0.3	0.3	0.5	0.4	0.3	0.4	0.4	0.4	0.4	0.2	0.4	0.5	14.8	3
2.6	3.5	3.6	3.0	1.8	2.3	3.2	2.3	1.6	1.7	1.5	1.8	1.5	1.2	1.4	1.1	1.0	1.0	1.5	1.6	1.2	1.3	1.1	1.4	44.2	4

(Cont.)

(Cont.)

No.	Sex	Age	Sugar	Participation (months)	Months of pregnancies	Weight (kg)	Length (cm)	Wrist-girth (cm)	Family relationship	Cooperat. coeff.	Profession
46	f	46	X	24	—	64.0	154	17.0	—	94	Tutor dent. as.
47	m	28	X	24	—	88.0	177	18.2	—	99	Electrician
48	f	29	F	24	2	63.0	166	15.6	49	99	Dent. student
49	m	29	F	24	—	105.0	188	18.6	48	99	Chem. student
50	f	26	F	24	—	65.0	168	14.0	—	99	Lab. technician
51	f	28	S	24	2	58.0	173	17.3	—	100	Dent. student
52	f	35	F	24	9	69.0	165	16.6	78	96	Dent. student
53	m	37	F	24	—	95.0	179	18.7	4	97	Salesman
54	f	33	X	24	—	57.0	160	16.3	—	96	Dent. assistant
55	f	40	X	24	—	66.0	164	15.8	—	94	Lab. technician
56	f	28	F	24	—	49.0	158	15.6	—	99	Dental assistant
57	f	39	S	24	—	88.0	165	17.1	—	100	Cleaner
58	m	18	S	24	—	63.0	176	16.0	13	100	Serviceman
59	m	25	X	24	—	98.0	184	18.8	—	99	Chem. student
60	f	24	X	24	—	61.5	169	15.5	—	89	Dent. student
61	m	30	F	24	—	93.0	178	18.7	17	100	Salesman
62	f	24	X	24	—	52.0	163	15.0	—	97	Dent. student
63	f	25	X	24	—	45.5	160	13.9	—	95	Dent. student
64	f	31	S	24	—	59.0	160	15.3	—	100	Dent. assistant
65	f	54	X	24	—	68.0	170	16.0	66	99	Hostess
66	m	55	X	24	—	93.0	177	20.0	65	95	Businessman
67	m	28	F	24	—	80.0	181	17.6	—	99	Dent. student
68	f	24	X	24	—	54.0	160	14.2	—	97	Dent. student
69	f	23	S	24	—	49.0	161	15.0	—	100	Dent. student
70	m	38	X	24	—	77.0	185	18.1	99	100	Salesman
71	f	23	F	24	—	44.0	158	13.5	—	94	Dent. student
72	f	24	S	24	9	88.0	167	14.8	—	100	Dent. student
73	f	25	X	24	—	60.0	168	15.9	83, 84, 91, 92	98	Dent. student
74	f	35	X	24	9	76.0	161	16.9	75	99	Secretary
75	m	38	X	24	—	71.5	175	18.2	74	100	Engineer
76	f	23	S	24	—	59.0	171	15.1	81, 82	100	Dent. student
77	f	23	S	24	1	58.0	162	15.0	—	99	Dent. student
78	m	36	F	24	—	90.0	176	17.4	52	98	Dent. student
79	m	30	S	24	—	78.0	171	16.4	80	100	Polit. student
80	f	24	S	24	—	57.5	173	15.2	79	100	Dent. student
81	m	26	S	24	—	64.5	185	16.6	82, 76	100	Dent. student
82	f	26	S	24	9	52.0	165	14.9	76, 81	100	Nurse
83	f	19	X	24	—	59.0	172	16.6	84, 91, 92, 73	99	College student
84	f	13	X	24	—	51.0	161	15.3	91, 92, 73, 83	99	College student
85	f	27	F	12	9	—	162	15.0	109	—	Dent. student
86	m	33	S	24	—	82.5	173	18.5	87	100	Engineer
87	f	32	S	24	—	60.5	163	14.9	86	100	Lab. technician
88	f	23	X	24	—	50.5	163	14.7	—	98	Dent. student
89	f	22	X	12	3	—	177	15.1	—	—	Dent. student
90	f	25	S	24	—	65.0	170	15.4	—	100	Dent. student
91	f	50	X	24	—	70.0	169	16.3	73, 83, 84, 92	100	Housewife
92	m	48	X	24	—	100.0	176	20.3	73, 83, 84, 91	100	Engineer
93	m	39	X	24	—	97.0	175	20.0	45	99	Guard
94	m	24	X	24	—	80.0	176	18.7	40	94	Dent. student

Monthly intake of sugar (kg)																									
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Total	Freq.
1.5	1.4	1.8	1.2	1.6	1.5	1.8	1.7	1.6	0.5	0.7	1.1	0.5	0.3	0.4	1.0	0.6	0.7	1.3	0.7	1.0	1.3	0.6	0.7	25.6	3
3.8	4.4	3.4	2.4	2.8	5.3	3.6	2.6	1.8	1.7	2.8	4.1	4.0	3.6	2.7	3.6	1.7	2.9	1.5	3.3	4.8	2.9	3.1	2.9	75.7	4
2.0	2.4	3.0	3.8	3.5	3.5	1.7	3.2	0.9	2.6	1.5	1.9	2.1	1.2	2.0	1.7	1.8	2.5	2.6	2.1	1.9	1.3	1.2	1.0	51.4	5
2.1	3.4	3.5	3.7	2.7	4.0	2.3	2.4	1.7	2.5	1.7	1.4	2.6	2.2	2.5	2.0	3.2	3.9	6.0	6.2	6.0	3.7	4.1	3.6	77.4	10
3.6	3.4	5.0	3.5	3.8	3.0	1.9	2.8	2.4	2.6	2.1	3.5	2.7	2.4	2.6	1.7	2.3	2.5	2.3	2.5	3.1	2.7	1.7	1.8	65.9	6
2.3	2.2	2.5	2.2	2.2	1.8	2.1	2.0	1.7	1.9	2.3	1.7	1.6	1.7	1.3	2.0	2.0	1.5	1.1	1.2	1.5	1.6	1.2	0.9	42.5	4
1.5	1.0	2.6	1.2	1.9	1.4	2.4	2.4	3.6	4.3	2.8	1.9	2.3	1.4	1.5	1.2	1.6	2.5	1.7	2.7	2.8	2.2	1.3	1.7	49.9	2
1.6	1.2	2.0	1.2	0.8	1.9	1.0	1.4	1.1	1.0	0.8	1.3	2.7	1.0	0.7	1.1	0.6	0.8	0.6	0.5	1.0	0.8	0.9	0.4	26.4	2
2.2	1.5	2.4	1.3	2.1	1.1	1.0	0.8	1.7	1.0	1.5	1.5	1.3	1.2	1.5	1.3	0.8	0.8	0.9	1.5	1.2	0.8	1.3	0.8	31.5	2
2.4	2.5	2.2	2.2	2.5	2.3	1.1	0.8	2.0	2.0	1.1	1.6	1.7	1.5	1.4	0.6	1.3	0.8	0.6	1.8	1.2	1.6	1.0	0.8	37.0	3
3.5	3.5	3.3	3.2	2.7	3.1	3.3	2.6	4.1	2.7	3.1	3.1	3.6	3.5	2.9	2.9	2.3	3.9	2.8	3.0	3.0	2.8	2.9	3.0	74.8	7
2.7	3.5	3.1	3.8	4.3	3.2	3.6	3.2	3.9	3.0	3.4	3.4	3.6	3.3	3.6	4.0	2.9	3.9	3.7	3.8	1.4	3.7	4.6	4.2	83.8	7
5.3	6.1	5.9	3.8	3.2	2.5	1.8	1.6	1.9	1.6	2.0	2.3	2.2	2.5	2.8	2.4	2.3	1.4	1.2	1.7	1.6	2.0	1.7	1.6	61.4	6
1.3	3.0	2.4	2.1	1.5	1.6	1.3	1.5	0.9	1.7	1.9	1.3	1.2	1.1	1.4	1.6	2.2	2.1	2.2	1.0	1.6	1.6	1.8	1.7	40.0	5
1.4	1.3	1.3	1.1	1.1	0.9	1.2	1.0	0.7	0.8	0.9	1.1	1.0	1.1	0.6	0.7	0.8	0.9	0.9	0.5	0.7	0.6	0.6	0.5	21.7	3
3.6	3.8	3.8	3.4	3.1	3.2	2.9	2.7	3.3	3.0	2.9	2.3	2.0	1.8	2.4	1.7	1.4	1.3	1.4	1.6	1.9	1.5	1.8	1.3	58.1	8
1.3	2.5	1.7	1.0	0.8	0.6	0.5	0.4	0.4	0.3	0.1	0.3	0.2	0.4	0.5	1.0	0.4	0.2	0.1	0.5	0.6	1.1	0.4	0.3	15.6	3
0.9	1.1	1.3	0.9	1.1	1.3	0.8	1.2	1.2	0.9	0.5	0.9	0.9	0.5	0.5	0.5	0.5	0.6	0.7	0.4	0.4	0.5	0.4	0.5	18.5	2
1.4	1.5	1.7	1.5	2.0	2.2	1.5	1.9	1.2	1.3	1.3	1.6	1.4	1.4	2.5	1.5	1.1	1.8	1.0	1.2	1.5	1.3	2.1	1.3	37.2	7
1.0	1.4	1.6	1.6	1.8	1.6	1.0	1.6	1.0	0.6	0.8	1.1	1.0	1.4	1.4	0.9	0.7	0.8	0.8	1.1	0.6	0.8	1.0	0.9	26.5	3
1.0	1.1	1.4	1.0	1.5	0.8	0.6	0.8	0.8	0.7	0.5	0.7	0.6	0.6	0.6	0.5	0.6	0.8	1.0	0.8	0.8	0.7	1.3	1.4	20.6	3
4.3	5.3	5.7	4.7	4.7	3.9	5.0	4.4	4.0	4.1	3.0	3.2	2.6	2.3	4.1	3.5	2.6	3.5	6.2	2.6	1.5	1.5	1.5	1.6	85.8	7
0.8	1.5	1.2	0.9	1.2	1.1	0.7	0.9	1.0	0.7	1.1	0.9	1.3	1.1	0.9	0.9	0.7	0.9	0.8	0.7	1.2	0.6	0.5	1.3	22.9	3
1.2	1.5	1.8	1.2	1.2	1.2	1.7	1.6	0.8	1.9	1.7	1.7	1.5	1.0	1.5	1.4	1.0	0.7	0.9	1.2	1.2	1.5	0.7	0.8	30.9	3
2.2	2.7	2.4	2.3	2.0	2.1	2.0	1.9	2.0	1.8	1.8	2.3	2.4	2.2	2.0	2.1	1.9	2.0	2.1	1.8	1.7	2.4	2.6	1.9	50.6	4
1.5	1.9	1.9	1.9	1.5	1.8	2.1	0.9	0.7	0.8	0.7	0.7	1.0	1.2	1.4	1.4	1.1	0.7	1.6	1.2	0.6	0.4	0.4	0.7	28.1	3
1.4	1.4	1.5	1.5	1.4	1.5	1.2	1.6	1.5	1.1	0.9	1.2	1.2	1.4	0.9	0.8	0.9	0.9	1.2	1.2	0.8	0.5	0.3	1.0	27.3	2
1.7	2.2	2.3	1.7	1.5	1.4	1.6	2.2	1.8	2.5	2.7	2.3	1.7	1.1	1.5	1.3	0.9	1.6	1.8	1.4	2.1	3.4	2.4	1.1	44.2	4
0.6	1.4	1.4	0.7	0.4	0.8	0.5	0.6	1.1	1.4	1.3	1.1	1.1	1.1	1.3	1.1	0.7	0.8	1.0	1.2	1.4	1.3	0.8	0.8	23.9	4
1.9	2.3	2.2	1.2	1.4	2.2	2.0	1.5	2.2	3.2	2.9	3.0	1.9	2.1	3.0	2.4	2.1	2.5	3.1	2.7	3.9	3.7	3.1	2.2	58.7	5
1.6	2.1	2.9	1.4	2.9	5.2	6.9	7.7	2.4	1.3	2.2	2.0	3.4	2.9	1.5	1.2	0.9	0.9	0.8	1.1	1.1	0.5	0.8	0.9	54.6	3
2.2	2.4	2.5	2.3	2.0	3.4	2.6	1.8	2.1	1.9	2.1	2.4	2.1	1.8	1.8	1.4	1.3	1.9	2.2	1.5	1.5	1.5	1.7	1.2	47.6	5
0.4	0.4	0.9	0.7	0.8	1.3	2.3	0.8	1.6	3.5	1.2	1.7	1.6	1.7	2.3	1.5	1.7	1.6	1.4	1.5	1.7	0.9	0.4	1.2	33.1	1
1.6	3.4	4.1	3.5	3.2	4.5	3.3	3.4	3.1	2.9	3.2	2.0	1.8	2.3	2.2	1.5	1.1	3.9	2.0	2.5	2.4	2.9	2.3	1.5	64.6	4
1.7	2.4	4.0	2.9	2.6	2.7	2.2	2.6	2.4	2.1	2.8	1.8	1.4	1.4	1.8	1.2	0.9	1.3	1.3	1.3	0.6	0.4	1.6	1.2	44.6	2
0.9	1.4	1.5	1.1	1.7	1.7	1.5	1.6	1.2	1.7	1.6	1.2	1.1	1.3	1.6	0.7	0.9	1.1	1.2	1.1	1.2	1.3	1.2	1.0	30.8	5
1.1	1.7	2.1	1.6	2.3	2.6	2.7	2.2	1.5	1.7	1.8	1.6	1.4	1.6	1.5	1.2	1.1	1.7	1.6	1.8	1.6	1.3	1.1	1.1	39.9	6
1.8	1.8	1.7	1.5	1.3	1.8	1.5	1.5	1.6	1.8	1.3	1.4	1.2	1.8	1.1	1.5	1.6	0.7	1.2	1.3	0.9	1.2	1.3	1.2	34.0	4
1.7	1.7	1.3	1.6	1.3	1.5	1.3	1.7	1.5	1.3	1.6	1.9	1.9	1.2	1.2	1.4	1.1	1.2	1.1	1.3	0.8	0.9	0.7	0.6	32.0	3
1.8	4.0	2.8	1.7	1.0	1.4	1.4	1.8	1.0	1.0	0.7	0.7	Discontinued												19.3	—
3.0	3.6	4.7	3.7	2.8	3.5	3.2	3.3	5.1	5.6	3.3	2.3	2.2	2.7	2.3	2.3	2.4	2.3	1.7	2.2	2.4	2.0	1.9	2.1	70.6	4
0.9	1.1	1.6	1.4	1.3	1.2	1.5	1.6	2.3	2.3	2.3	1.6	1.7	2.0	1.9	1.5	2.0	1.8	1.3	1.6	2.3	1.8	1.2	1.5	39.7	4
1.2	1.6	2.5	1.4	1.4	2.4	1.5	1.6	1.4	1.4	1.0	1.2	1.2	0.9	0.9	0.7	0.8	1.0	0.7	0.7	0.6	0.6	0.5	0.6	27.8	3
0.9	0.7	0.5	0.6	0.6	0.6	0.9	0.7	Discontinued																5.5	—
0.6	0.9	1.4	1.3	0.8	1.1	1.3	1.0	1.2	1.5	1.8	1.1	1.0	0.8	1.5	1.0	0.5	0.8	0.2	0.7	1.0	0.8	1.0	1.2	24.5	3
1.3	2.2	1.9	1.6	1.3	1.4	1.4	1.4	2.0	2.4	2.3	1.9	1.3	1.3	1.5	1.1	0.9	1.5	1.1	1.2	1.4	1.4	1.6	1.4	36.8	3
0.9	1.4	1.4	1.1	0.9	1.1	1.2	1.3	1.6	1.5	1.0	1.3	0.9	1.2	1.4	1.3	1.1	1.5	1.1	1.1	1.4	1.7	1.5	1.5	30.4	3
2.9	3.2	3.4	2.4	2.3	2.3	3.2	2.7	2.4	2.2	1.7	1.8	2.0	1.6	1.7	1.8	1.4	1.5	2.1	2.3	1.5	1.8	1.3	1.4	50.9	
2.4	2.5	3.2	2.9	2.2	3.5	2.1	2.3	2.1	2.1	2.2	2.7	1.6	1.7	2.1	1.4	2.3	2.3	2.3	2.3	2.3	2.2	1.5	2.3	54.5	3

(Cont.)

(Cont.)

No.	Sex	Age	Sugar	Participation (months)	Months of pregnancies	Weight (kg)	Length (cm)	Wrist-girth (cm)	Family relationship	Cooperat. coeff.	Profession
95	m	23	F	24	—	68.0	177	16.7	—	99	Dent. student
96	f	25	F	24	—	59.0	170	15.6	—	88	Dent. student
97	f	23	S	24	—	67.0	168	16.6	—	100	Dent. student
98	f	25	F	24	—	50.0	160	14.9	—	96	Med. student
99	f	37	X	24	—	62.0	162	15.6	70	100	Dental assistant
100	f	19	X	24	—	54.5	169	15.0	10, 101	99	College student
101	m	43	X	24	—	93.0	180	18.9	10, 100	98	Police officer
102	f	17	X	24	—	52.0	165	14.6	—	100	College student
103	f	28	X	11	—	—	168	14.6	—	—	Dent. student
104	m	29	X	5	—	—			—	—	Reporter
105	f	25	X	24	15	44.0	160	14.2	122	93	Dent. student
106	f	24	F	24	9	52.0	165	15.2	—	97	Dent. student
107	f	25	S	24	—	61.0	156	17.1	121	92	Dent. student
108	f	23	F	24	—	85.0	170	16.0	—	—	Dent. student
109	m	28	F	12	—	—	189	17.0	85	—	Med. student
110	f	23	S	24	9	67.0	167	16.3	111	100	Dent. student
111	m	25	S	24	—	91.0	184	20.0	110	100	Med. student
112	m	26	X	24	—	70.0	183	17.3	—	80	Dent. student
113	m	24	X	24	—	75.0	178	17.0	—	—	Dent. student
114	f	26	X	24	—	60.0	163	16.2	—	97	Dent. student
115	m	23	X	3	—	—			22	—	Dent. student
116	f	25	F	24	—	57.0	157	15.9	—	98	Dent. student
117	f	27	F	24	—	64.0	174	16.0	—	92	Dent. student
118	f	25	X	24	—	52.0	166	15.4	—	96	Dent. student
119	f	24	S	24	—	54.0	161	15.4	120	100	Med. student
120	m	24	S	24	—	78.0	183	17.9	119	100	Med. student
121	m	21	S	24	—	80.0	185	17.5	107	100	Dent. student
122	m	28	S	24	—	83.0	180	17.2	105	100	Pol. student
123	f	45	X	24	—	69.5	162	16.0	—	98	Cleaner
124	f	48	X	24	—	69.0	154	15.8	—	97	Lab. technician
125	f	24	S+X	24	10	66.0	169	15.6	126	—	Psych. student
126	m	25	S+X	20	—	74.0	182	16.7	125	—	Dent. student
127	m	24	X	21	—	74.0	179	16.7	—	97	Med. student

Monthly intake of sugar (kg)																									
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Total	Freq.
1.6	1.9	2.3	1.9	1.8	1.6	1.7	1.8	1.6	1.5	2.3	1.4	1.8	1.6	2.3	1.6	1.3	1.4	1.5	1.3	1.3	1.6	1.5	1.3	39.9	8
2.0	2.2	3.1	2.9	2.7	2.7	3.3	3.3	3.3	1.5	2.6	3.4	2.7	2.9	2.7	2.7	3.3	2.4	2.5	2.1	2.0	2.4	1.8	2.6	63.1	5
2.6	2.2	3.0	2.6	2.2	2.1	2.0	2.1	2.5	2.2	2.2	1.7	1.9	1.5	1.2	1.2	1.8	0.8	1.8	1.8	1.0	1.8	0.8	1.1	44.1	7
1.3	1.3	1.7	1.0	1.3	1.2	1.4	1.5	1.5	1.2	1.2	1.0	1.2	0.9	1.1	1.0	0.9	1.1	0.8	0.8	1.0	0.6	0.7	0.9	26.6	4
1.4	2.0	2.1	1.6	1.2	1.5	0.8	1.1	1.8	1.9	1.5	1.1	1.4	1.5	1.3	0.9	1.3	1.4	1.2	1.6	1.5	1.7	1.9	1.2	34.9	3
2.1	2.1	1.7	1.7	1.6	1.1	0.9	1.4	0.8	1.1	1.4	1.7	1.3	1.5	1.8	1.5	1.5	1.7	1.2	0.9	0.5	0.8	1.0	0.8	32.1	7
1.8	2.2	3.0	2.4	1.9	2.5	2.2	2.2	2.2	2.3	2.5	2.5	2.4	2.2	2.4	2.2	2.1	2.8	2.8	2.3	2.0	3.0	3.9	2.3	58.1	7
0.8	1.1	1.3	1.0	0.9	1.1	1.2	1.1	0.8	1.0	1.2	0.9	1.2	1.3	1.0	1.6	1.3	1.8	2.1	1.8	1.7	1.3	1.1	1.3	29.9	2
0.7	1.0	0.9	0.9	0.9	0.7	0.7	0.3					Discontinued												6.1	—
																Weak cooperation, discontinued								—	—
0.9	0.7	0.6	0.2	0.1	0.3	0.2	0.5	0.6	0.8	0.5	1.2	0.6	0.6	1.9	0.9	0.3	0.5	0.5	0.9	0.1	0.4	0.2	0.4	13.9	1
1.5	1.8	2.4	1.4	1.7	2.0	2.0	2.5	1.9	0.9	1.2	1.2	2.0	1.8	2.0	1.9	1.4	1.8	1.8	1.2	1.4	0.8	0.7	1.3	38.6	3
1.4	2.5	2.4	2.7	1.6	2.0	1.9	2.2	2.1	1.2	1.6	2.6	2.4	2.5	2.7	1.9	2.1	1.6	2.0	2.0	0.6	0.8	1.9	1.5	46.2	3
												No information obtained												—	—
1.2	2.8	3.5	3.3	2.4	1.8	1.8	1.8	1.1	0.9	0.8	0.8								Discontinued					22.2	—
0.9	1.5	1.7	1.8	1.5	1.5	1.1	1.1	1.1	1.0	1.1	0.9	1.1	1.1	0.9	0.8	0.7	0.7	1.0	1.3	1.0	1.3	1.0	0.8	26.9	5
1.6	2.0	2.1	2.2	1.9	2.0	1.6	1.5	1.9	1.9	1.8	1.2	1.8	1.7	1.6	1.1	1.0	1.2	1.5	1.2	2.0	1.5	1.9	1.2	39.4	5
1.1	1.7	2.0	1.4	1.4	1.2	0.9	1.0	1.4	1.4	1.4	1.5	1.0	0.9	1.2	1.0	1.1	0.9	1.7	1.2	1.5	1.0	1.6	1.2	30.7	2
2.6	2.6	2.1	1.8	2.0	2.5	2.4	2.6	0.1	0.1	0.1				Weak cooperation, excluded										18.9	1
0.9	1.0	1.3	1.4	0.9	0.7	0.8	1.1	1.2	1.4	0.8	1.8	1.2	1.4	0.9	0.7	0.6	1.3	0.5	0.5	0.6	0.8	0.8	0.5	23.1	2
													Discontinued											3.5	—
2.7	1.1	2.9	2.2	1.0	1.2	1.0	2.0	1.4	1.3	1.4	1.2	1.8	1.5	0.9	0.7	1.0	0.5	0.5	0.8	0.9	0.6	0.9	0.8	30.3	3
1.5	1.9	1.8	1.5	1.4	1.2	1.2	1.5	1.5	1.0	0.4	1.6	1.4	0.9	1.1	0.9	1.1	1.2	0.8	0.7	1.4	0.5	0.2	0.7	27.4	2
2.6	2.0	2.8	2.0	1.5	1.6	1.8	1.6	0.5	0.5	1.2	1.4	1.3	1.3	0.9	1.0	1.3	1.2	1.2	0.9	0.8	0.8	0.4	0.8	31.4	3
3.7	3.7	3.5	2.9	2.3	2.9	3.2	3.3	2.4	2.6	2.5	2.5	3.1	2.4	3.3	3.7	2.9	3.1	2.7	2.6	3.8	3.2	2.6	3.0	71.9	7
3.1	3.7	4.2	2.7	3.0	3.8	3.5	3.4	2.9	4.2	4.1	3.3	4.0	3.5	3.6	3.6	3.0	3.5	3.7	3.4	3.7	3.2	3.4	2.9	83.4	8
1.4	2.5	2.4	2.7	1.6	2.0	1.9	2.2	1.2	1.1	1.3	1.3	2.3	1.8	1.2	0.6	0.3	0.1	0.2	0.1	0.2	0.2	0.3	0.4	29.3	4
2.2	2.7	3.7	1.8	1.8	2.2	1.9	1.3	1.9	1.7	1.7	1.4	1.2	1.5	2.2	1.2	1.0	1.2	1.3	0.6	0.7	1.3	1.5	1.8	39.8	3
2.4	2.7	2.9	4.4	3.1	2.9	2.3	3.1	2.6	2.2	2.6	2.5	2.8	2.7	2.5	2.8	2.8	2.9	2.5	2.9	2.0	2.4	2.1	4.2	66.3	5
2.5	7.0	4.9	3.2	2.3	3.9	3.0	3.1	3.1	5.4	2.6	2.6	2.7	1.9	2.6	2.4	1.5	2.7	2.2	1.8	2.1	1.5	2.1	1.2	68.3	4
1.7	2.1	2.0	2.6	2.1	1.6	3.0	0.9	1.2	1.2	1.6	1.5	1.1	1.2	1.2	0.6	0.9	cf. Table II. Not included in							26.5	—
2.4	4.1	3.8	2.1	1.4	1.1	1.0	0.7	0.7	0.9	0.7	0.8	1.0	0.8	0.8	0.7	0.8	calculations							23.8	—
1.0	1.5	2.3	1.6	0.9	1.9	0.9	0.9	1.1	1.3	1.0	0.8	0.9	1.1	0.8	1.0	1.3	1.0	1.0	0.3	1.2	No information for last three months			23.8	3