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NUTRITIONAL AND VITAL STATISTICAL FEATURES OF THE HUNGARIAN POPULATION: A REVIEW ABOUT THE PAST 25 YEARS

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The authors' aim is to reveal the reflection of Hungarian political and economic transformation in the public health nutrition during the last two and a half decades. Results of the four representative, nationwide dietary surveys completed in this period have been analysed for macro-, micronutrient intakes, and overweight/obesity. The food consumption-related vital statistics provided by Hungarian Central Statistical Office were also analysed and compared. There are certain signs of favourable improvements: slight decrease of energy intake in females, growing share of plant protein, less saturated, more polyunsaturated fatty acid intake, less sugar. These findings are in parallel with some positive general statistical issues: the extension of life expectancy, lesser acute myocardial infarction, atherosclerosis and stomach cancer mortality, more vegetables and fruit, lesser lard, more oil consumption. On the other hand there are several detrimental nutritional issues that influence the health status of Hungarian population: still high energy, fat and cholesterol intake, low complex carbohydrates, too much sodium (salt), insufficiencies in some vitamin, macro- and microelements intake. The number of overweight/obese people takes up fairly high level. The surveys somewhat revealed the role of nutrition in the health status of population and now a particle of possibility for its improvement is available

Keywords: nutrition survey, food consumption, nutrient intake, diet-related diseases

Abbreviations: AMI: acute myocardial infarction; BMI: body mass index; CPHES: County Public Health and Epidemiology Station; dis.: disease(s); equ: equivalent; HCSO: Hungarian Central Statistical Office; MUFA: monounsaturated fatty acid(s); n.e.: no entry; NIFHN: National Institute of Food Hygiene and Nutrition; PUFA: polyunsaturated *fatty* acid(s); SFA: saturated fatty acid(s); 1S: First Hungarian Representative Nutrition Survey, 1985-1988; 2S: Hungarian Nutrition Survey in a Randomized Trial, 1992-1994; 3S: Hungarian National Dietary Survey, 2003-2004; 4S: Dietary Survey in Hungary, 2009

In the past period beginning in 1985 four rather comprehensive nutrition surveys have been carried out and their results could be used by the Hungarian professionals dealing with the issues of public health nutrition. This prosperous condition provides a highly valuable background to summarize and evaluate the nutritional trends that refer to the risk of diet-related disorders, to the level of nutrient supply, to the food and nutritional security. During this period crucial political and economic transformation occurred which significantly influenced the nutritional conditions. This comprehensive review is aimed to giving information about their consequences in the Hungarian public health nutrition.

The surveys undoubtedly had somewhat different structures, and the number of investigated subjects was considerably different. The First Hungarian Representative Nutrition Survey (hereafter 1S) has been carried out countrywide (in all the 19 counties and the capital) between 1985-1988 (Biró, 1992a; Biró, 1992b; Biró, 1994a; Biró, 1994b; 1994c; 1996). The sample of people to be examined was selected by the National Population

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Registration Office and it represented on 0.2 per cent level the whole population over 14 years of age, according to age, gender, and domicile. Finally 16641 subjects (7042 males, 9599 females) have been interviewed and measured regarding their nutritional attributes and lifestyle, basic anthropometric parameters, blood pressure, respectively. (At that time the total number of inhabitants in Hungary somewhat exceeded 10 million.) Blood samples for laboratory analysis (serum lipids, macro- and micronutrient supply) were collected from approximately one third of subjects.

In a quasi random survey of 1992–1994 (hereafter 2S) 2559 volunteers (1173 males, 1386 females) participated from 11 counties and Budapest (Biró, 1996; Biró et al., 1996; Biró, 1997). The majority of investigated subjects belonged to the young (18–34 y) and the middle-aged (35–59 y) age group (26.6 and 65.2%, respectively) and only 6.2% were 60 and over years old.

In 2003–2004 (thereafter 3S) a dietary survey the NIFHN conducted joint to the National Health Assessment Study for the adult population over 18 years randomly selected from all regions of the country founded on the database of national census (Hungarian National Dietary Survey 2003–2004) (Rodler et al., 2005; Biró et al., 2007; Zajkás et al., 2007). The interviewers of the Hungarian Central Statistical Office (HCSO) saw the selected subjects about filling in nutritional questionnaires (on the basis of verbal message) and then about forwarding them to the central processing institution. From 1362 responders 1179 (473 males, 706 females) appropriate questionnaires were returned.

In 2009 (thereafter 4S) the Hungarian Food Safety Office initiated a nationwide nutrition survey representing the whole population (Dietary Survey in Hungary 2009) (Szeitz-Szabó et al., 2011; Biró et al., 2011). The survey was carried out joining to the National Household Budget Survey (HBS). The response rate was above 80% and included 4992 responders. Among them 3982 referred to adults above 18 years. After validation, 3077 (1360 males, 1717 females) questionnaires were found suitable for processing and used for comparison to the previous surveys.

1. Methods of data collection in issues reviewed in this contribution

Preparing the 1S, the co-workers of the National Institute for Food Hygiene and Nutrition (NIFHN) elaborated the questionnaires for the 24-hour recall, food frequency, lifestyle conditions. The nutritional experts of the former County Public Health and Epidemiology Stations (CPHES) performed the interviews and measurement after a practical training in the NIFHN. The 24-hour recalls related to the last workday and Sunday. For the summarized evaluation the weighted average was computed on the basis of Hungarian Food Composition Tables (Biró & Lindner, 1988). The body mass and height were measured with the tools of CPHES, the body mass index (BMI) was calculated as usual: kg/cm^2.

In the case of 2S the dieticians of NIFHN interviewed and investigated the subjects. They keyed in the data applying a notebook computer programme elaborated for these issues. Almost the same examination methods were employed in both surveys but in the second one the methods were supplemented by another, non-consecutive working day diet (altogether 3×24-hour recall). In both cases the participants got in advance a request to note the food consumed for the sake of a more exact recall. Thus the data acquisition meant the combination of dietary recall and – in some extent – dietary record. The methods of anthropometric measurements, the data collection and processing are identical with that of first survey.

In the case of 3S the trained interviewers of HCSO visited the potential responders. They demonstrated the 24-hour recall method, and then handed over the questionnaires for 3×24-hour record asking the participants for filling in and sending back them. The body mass and height were self-reported, also in the fourth survey.

The method of 4S was again based on three-day records and food frequency questionnaires. The survey forms with a filling guidance and a picture book of different portion sizes were distributed along participants by HCSO interviewers and collected later by the same persons. The interviewers received special training on collecting food consumption information before the start of the survey.

The evaluation of energy and nutrient content in consumed foods has been accomplished in 2S-4S by means of NutriComp software (Rodler et al., 2005; Biró et al., 2007; Zajkás et al., 2007) developed in Hungary. For statistical processing SPSS for Window 9.0 programme was employed in each survey.

2. Results

2.1. The general statistical background

Before the recital of the crucial results of nutrition surveys it seems to be proper to sum up the general statistical background regarding the nutrition-related phenomena and the food supply, based on database of HCSO. The life expectancy provides an overall accepted indicator of population's well-being. In this period the life expectancy at birth of males increased about three and a half years, that of females nearly four years. The Table 1 contains the details.

Table 1. Life expectancy at birth in Hungary 1985–2005
(CENTRAL STATISTICAL OFFICE, 2005, 2009)

Year	Life expectancy, years	
	Males	Females
1985	65.09	73.07
1990	65.13	73.71
1995	65.25	74.50
2000	67.11	75.59
2005	68.56	76.93

The mortality of main diet-related diseases shows a mixed pattern (Table 2). The mortality of acute myocardial infarction slowly decreases but that of total ischemic heart disease grows. The fatal outcomes of cerebrovascular diseases, atherosclerosis, moreover stomach cancer favourably lessen, on the other hand that of hypertension and colon cancer is rising.

Concerning the staple food consumption a favourable tendency is noticeable: reduction of lard, increase of edible oil (mainly sunflower-seed oil) and margarine, moreover that of vegetables and fruit, although the consumption of the last item is lower in 2005 than in 2000 (Table 3). We should point out that the official statistical data based on macroeconomic items (domestic production, export, import) considerably differ from the results of nutrition surveys which approach near the true condition. Also this fact strongly accentuates the importance of

these surveys. However, the statistics provides an opportunity for the researchers to outline the common situation, the tendency of processes. For this reason we emphasize the following details. The total daily consumption of vegetables and fruit exceeded 500 grams in 2005, while at the beginning of the period it did not reach the recommended 400 grams/day. It seems to be an important fact that the structure of fat consumption has changed in the right direction. The consumption of meat, meat products, eggs and flour decreased, that of potatoes increased. The use of milk and dairy products – after a significant transitory decline – remained on a lower level. We cannot leave unmentioned the fact that in 1995 a remarkable temporary fall happened in the consumption of many foods (meat, meat products, milk, dairy products, and fruits), probably as a consequence of economic conversion.

Table 2. Mortality causes of some diet-related diseases (CENTRAL STATISTICAL OFFICE, 1986, 1991, 1996, 2001, 2006) (Mortality per hundred thousand inhabitants)

Year	Ischaemic heart dis./AMI	Cerebrovasc. diseases	Hypertension	Athero-sclerosis	Malignant neoplasms of	
					stomach	colon
1985	260.4/135.9	222.0	52.6	119.4	29.4	20.1
1990	271.9/139.4	206.0	55.7	110.1	27.9	24.3
1995	300.5/143.0	195.6	44.6	95.2	25.3	26.8
2000	297.27/112.85	188.93	47.18	75.32	21.62	29.24
2005	365.75/101.59	154.23	63.74	51.06	17.07	29.25

Table 3. Consumption of staple foods in Hungary 1985–2005 (CENTRAL STATISTICAL OFFICE, 1986, 1991, 1996, 2001, 2005, 2006, 2009) (Annual average per capita, kg)

Year	Meat, meat products	Milk, dairy products	Eggs	Flour	Lard	Edible oil	Margarine	Potatoes	Vegetables	Fruit
1985	79.1	182.0	18.0	106.3	22.9	5.3	2.6	54.1	75.6	71.0
1990	73.1	169.9	21.6	106.2	24.2	8.0	3.8	61.0	83.3	72.3
1995	63.1	133.4	16.7	84.1	19.6	9.6	5.6	60.9	91.6	58.3
2000	70.2	160.6	15.3	89.4	18.0	10.6	7.4	64.0	109.2	108.5
2005	63.5	166.8	16.0	91.2	13.4	11.6	8.4	66.8	112.1	82.7

The energy and macronutrient intakes calculated from the food consumption do not indicate relevant changes but for a slight decrease in energy coming from less fat and carbohydrate (Table 4). The share of protein and animal protein remained practically unchanged. The entries in 1995 demonstrate the transitory fall mentioned above.

Table 4. Average daily energy and nutrient intakes in Hungary (CENTRAL STATISTICAL OFFICE, 1986, 1991, 1996, 2001, 2003, 2008) (Calculated from the statistics of average food consumption)

Year	Energy, kJ	Protein, g	Animal protein, g	Fat, g	Carbohydrate, g
1985	13599	105.3	59.2	141.9	390.2
1990	14162	104.7	58.2	152.5	401.0
1995	12473	87.7	48.5	137.2	351.4
2000	13270	96.6	53.5	147.8	367.9
2005	13719	105.4	59.2	144.0	395.3

2.2. Comparative appraisal of four Hungarian nutrition surveys

2.2.1. Energy and macronutrients. It is undoubtedly true that the results of the four surveys – because of the aforesaid considerable differences – are statistically difficult to compare and evaluate, but the time series formed from the results of surveys give comprehensive information about the trends of changes, about the features of differences. We should to lay special emphasis on this.

In the period examined the energy intake of males did not practically change aside from a not too sizeable increase in the 2nd survey (Table 5). In case of females a slight decrease is shown. During the last decades the living conditions have been significantly transformed (sedentary lifestyle, motorization, up-to-date productive equipments etc.), therefore less physical activity in working and leisure time was effectuated/accomplished, but the nutritional patterns remained constant, the energy balance turned more and more into a positive peculiarity.

Table 5. Average daily energy intake (kJ) calculated from the dietary surveys

	1S		2S		3S		4S	
	Mean	SD.	Mean	SD.	Mean	SD	Mean	SD
Male	11928	3864	13700	3600	11668.6	2383.6	11960.8	2720.7
Female	9392	2869	10000	2800	9218.3	1793.2	8919.5	1794.1
Altogether	n.e		11700	3700	10201.3	2375.8	10263.7	2710.7

The protein intake shows the same phenomenon as the energy intake, but there is a favourable fact, i.e. the upward tendency in plant protein intake (Table 6). Unquestionably, it is first of all the consequence of macroeconomic modifications, changes in the relationship between the population's income and food prices, not the active nutritional education, albeit it is difficult to deny its positive role.

The average total fat intake indicates an appreciable decrease in both genders (Table 7). The importance of this lucky change will be more revealed by the analysis of fatty acid pattern.

Table 6. Average daily protein intake (g) and the percentage of plant protein

	1S			2S			3S			4S		
	g		%	g		%	g		%	g		%
	Mean	SD.		Mean	SD		Mean	SD		Mean	SD	
Male	108.0	35.7	35.0	118.8	34.3	35.4	102.0	23.6	39.8	106.3	27.0	40.3
Female	85.4	26.7	36.2	86.0	24.7	40.8	79.7	18.0	42.1	79.1	17.3	41.4
Altogether		n.e		101.0	33.7	40.2	88.6	23.1	41.1	91.1	25.9	40.8

Table 7. Average daily total fat intake (g)

	1S		2S		3S		4S	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Male	131.1	50.9	139.6	45.5	118.7	33.3	122.5	35.3
Female	101.9	37.0	101.6	34.2	90.1	23.5	86.9	23.3
Altogether	n.e.		119.0	44.0	101.6	31.2	102.6	34.2

The amount of ingested saturated fatty acids by both genders was expressively lower in the last two surveys, but regrettably the intake of monounsaturated fatty acids is just the same (Table 8). The proportion of SFA, MUFA and PUFA has taken a turn somewhat better in the investigated period (from 1S to 4S): the proportion of SFA diminished from 16 %en to 11%en, that of PUFA increased from 4%en to 9%en in both gender while the proportion of MUFA slightly decreased (from 16%en to 13%en in males and to 11%en in females, respectively). This phenomenon corresponds to changes in fat types consumed. The cholesterol intake became a little bit lower; however, its level remained alarmingly high, far over the recommended 300 mg/d (WHO, 2003).

The total carbohydrate intake oscillated to a certain extent in both genders but it practically remained on the same level (Table 9). On the contrary, the amount of added sugar has lessened.

The percentage of energy provided by the macronutrients takes precedence among the principia of nutritional science commonly accepted. The properly proportioned nutrients contribute to the maintenance or promotion of health, together with their adequate amounts. The protein ratio approximately corresponds to the WHO recommendation (WHO, 2003), it ranges about 15%en. The fat rate is far higher than recommended (15-30%en), but it got a little reduced. The fat provided in 1S 41.3 (males) and 40.8 (females) percentage of the daily average energy intake but 38.5 and 36.7 percentage in 4S, respectively. The percentage of total carbohydrates does not reach the proposed level (55–75%en), while that of added sugar exceeds 10%en in the 1S and 2S. However, in the cases of 3S and 4S a favourable tendency is observable: the total carbohydrate slowly heightened; the added sugar significantly decreased (Table 10).

The body mass, or rather the body mass index appears as one of the final consequences of energy providing macronutrients (evidently taking the energy expenditure into consideration). The BMI values in the predominant share of the population indicate overweight or obesity of different degree. The overweight/obesity epidemic does not lessen; moreover it seems to become more severe (Table 11). During the last 25 years the frequency of overweight together with obesity has arisen, explicitly in males and slightly in females.

Table 8. Average daily fatty acids (g) and cholesterol (mg) intake

	1S								2S							
	SFA		MUFA		PUFA		Cholesterol		SFA		MUFA		PUFA		Cholesterol	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Male	49.2	19.8	51.5	21.0	12.0	5.7	531.3	271.2	51.1	17.5	55.5	18.8	14.2	5.9	585.4	261.2
Female	38.6	14.5	39.2	15.3	9.3	4.3	417.6	208.4	37.3	12.8	39.8	14.1	10.9	5.1	410.1	177.8
Altogether	n.e.		n.e.		n.e.		n.e.		43.6	16.6	47.0	18.2	12.4	5.7	490.4	236.6

	3S								4S							
	SFA		MUFA		PUFA		Cholesterol		SFA		MUFA		PUFA		Cholesterol	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Male	36.3	11.9	38.9	13.6	27.2	8.9	453.0	177.2	36.4	12.3	39.8	13.9	29.3	9.3	504.7	192.7
Female	27.0	8.1	27.9	8.8	22.4	7.3	327.2	125.4	25.7	8.2	26.8	8.9	22.3	6.9	344.8	127.1
Altogether	30.7	10.8	32.3	12.2	24.3	8.3	381.7	162.6	30.5	11.5	32.6	13.1	25.4	8.8	415.5	178.1

Table 9. Average daily total carbohydrate (CH) intake and the quantity of added sugar (S) (g)

	1S				2S		3S		4S	
	CH		S		CH	S	CH	S	CH	S
	Mean	SD	Mean	SD						
Male	286.6	105.9	92.4	63.4	355.5±106.1	112.8±60.4	310.9±72.4	55.7±40.2	317.5±80.2	50.2±35.3
Female	240.9	84.9	85.4	52.3	273.0±82.1	97.7±44.9	262.7±58.4	47.9±30.9	252.6±56.7	44.0±26.2
Altogether	n.e.		n.e.		310.8±102.5	104.6±53.1	282.1±68.5	51.0±35.1	281.3±75.3	46.7±30.7

Table 10. Energy percentage of macronutrients and added sugar

	1S								2S							
	Protein		Fat		Carbo-hydrate		Added sugar		Protein		Fat		Carbo-hydrate		Added sugar	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Male	15.4	2.8	41.3	6.9	40.5	7.3	12.9	6.6	14.6	2.1	38.1	5.8	43.6	6.4	13.8	5.9
Female	15.5	2.8	40.8	6.6	41.1	7.3	15.3	7.1	14.6	2.1	38.0	5.6	46.4	6.4	16.7	6.6
Altogether	n.e.		n.e.		n.e.		n.e.		14.6	2.1	38.0	5.7	45.1	6.5	15.4	6.4

	3S								4S							
	Protein		Fat		Carbo-hydrate		Added sugar		Protein		Fat		Carbo-hydrate		Added sugar	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Male	14.7	2.0	38.2	5.9	45.0	6.6	7.9	5.2	15.0	2.0	38.5	5.5	44.7	5.9	7.0	4.4
Female	14.6	1.9	36.8	5.4	48.0	5.8	8.6	4.8	15.0	2.0	36.7	5.3	47.7	5.6	8.2	4.3
Altogether	14.6	2.0	37.4	5.6	46.8	6.3	8.3	5.0	15.0	2.0	37.5	5.5	46.4	5.9	7.6	4.4

Since in the 3S and 4S the weight and height were self-reported, the true situation supposed to be more unfavourable. The first and second surveys slightly differ from the third and fourth ones in the cut-off points because of changes in the WHO recommendations (WHO, 1988; 2000), but it did not perceptibly influence the percentage of overweight and obese subjects.

Table 11. Percentage of subjects belonging to different BMI categories

	1S				2S			
	<20	20–25	>25–30	>30	<20	20–25	>25–30	>30
	kg/m^2				kg/m^2			
Male	3.9	42.8	42.8	10.2	4.1	33.0	41.9	19.9
Female	8.3	44.0	34.9	12.1	8.7	42.2	27.9	21.2

	3S				4S			
	<18.5	18.5–24.9	25–29.9	≥30	<18.5	18.5–24.9	25–29.9	≥30
	kg/m2				kg/m2			
Male	0.4	40.7	41.8	17.1	1.1	35.9	44.6	18.4
Female	3.0	47.5	31.3	18.2	4.1	47.8	30.9	17.2
Altogether	2.0	44.8	35.5	17.7	2.8	42.5	36.9	17.8

1S: First Hungarian Representative Nutrition Survey, 1985-1988; 2S: Hungarian Nutrition Survey in a Randomized Trial, 1992-1994; 3S: Hungarian National Dietary Survey, 2003-2004; 4S: Dietary Survey in Hungary, 2009

2.2.2. Micronutrients

2.2.2.1. Vitamins. In general the average vitamin intake shows certain insufficiency but it does not indicate noteworthy deficiency, though it does not exclude the intake in some groups below the desirable level (Table 12). As the details: the retinol equivalent intake just reaches the recommended amount in the first three surveys, but in *4S* the intake does not attain the Hungarian recommendation (Antal, 2005), whereas in males the intake meets the EU RDA (2008) but that in females rests below it. The vitamin E intake is considerably low in *1S* and *2S*, presumably because the food composition tables used for calculation have proven to be insufficient in this respect but the *3S* and *4S* indicate appropriate intake. The cause of the fact may be also the higher vegetable oil consumption. The average intakes of vitamin D, folate, panthotenic acid and biotin are below the recommended amounts, same as ascorbic acid but *2S* and *4S* males excepted. The data does not include intakes from dietary supplements and fortified foods so the actual intake might slightly differ.

2.2.2.2. Macroelements. The high sodium intake provides worldwide a cardiovascular risk factor. Hungary does not form an exception; the sodium intake runs to 3.5-4 times higher than accepted (Table 13). The potassium intake is below the Hungarian RDI (Antal, 2005), but over the EU RDA (2008). As a consequence of this the sodium/potassium ratio is rather high, about 2.4–2.8 g/g instead of approximately 0.6 g/g. The low calcium intake shows another common issue pregnant with consequences. Maybe the growing consumption of milk and dairy product will promote to solve this severe problem of clinical and public health importance. The magnesium intake in both genders fills the Hungarian recommendations but in females it only approaches the EU RDA level.

Table 12. Average daily intake of vitamins

		1S		2S		3S		4S		Hung. recom.[2]	EU RDA[3]
		Mean	SD	Mean	SD	Mean	SD	Mean	SD		
Male	Carotenoids, mg	2.4	1.7	2.6	1.8	2.2	1.9[1]	2.9	1.8[1]	n.e.	
	Retinol equ., mg	1.0	1.2	1.1	1.2	1.0	0.9	0.8	0.8	1.0	0.8
	Vitamin E equ., mg	7.4	4.4	8.1	4.5	16.0	5.8	18.2	6.1	15	12
	Thiamin, mg	1.3	0.6	1.4	0.6	1.1	0.3	1.2	0.4	1.1	1.1
	Riboflavin, mg	1.5	0.7	1.7	0.8	1.4	0.5	1.5	0.5	1.6	1.4
	Vitamin B_6, mg	2.4	2.4	2.4	0.7	1.9	0.5	2.1	0.6	1.3–1.7[5]	1.4
	Niacin equ., mg	25.8	10.0	25.0	8.7	38.8	9.9	41.3	11.2	18	16
	Vitamin B_{12}, µg	6.8	12.6	6.7	7.7	4.0	2.9	3.6	2.8	2	2.5
	Ascorbic ac., mg	77.0	67.6	102.6	73.2	78.6	49.7	94.2	65.9	90	80
	Vitamin D, µg	n.e.		n.e.		2.2	1.2	2.8	1.9	5	5
	Folate equ., µg	n.e		n.e.		151.8	52.9	165.5	62.7	200	200[4]
	Pantothenic ac., mg	n.e.		n.e.		3.9	1.3	4.1	1.5	5	6
	Biotin, µg	n.e.		m.e.		31.5	8.9	34.3	10.4	n.e.	50
Female	Carotenoids, mg	2.3	2.0	2.7	2.0	2.3	2.0[1]	2.7	2.2[1]	n.e.	
	Retinol equ., mg	0.9	1.1	1.0	0.9	0.9	0.9	0.7	0.8	0.8	0.8
	Vitamin E equ., mg	6.3	3.6	7.3	4.0	13.9	6.0	14.3	5.1	15	12
	Thiamin, mg	1.0	0.4	1.0	0.3	0.9	0.3	0.9	0.3	0.9	1.1
	Riboflavin, mg	1.3	0.5	1.3	0.5	1.2	0.5	1.2	0.4	1.3	1.4
	Vitamin B_6, mg	2.0	2.4	1.8	0.6	1.6	0.4	1.7	0.5	1.3-1,5[5]	1.4
	Niacin equ., mg	19.6	7.7	17.5	6.1	30.4	7.5	30.5	7.5	14	16
	Vitamin B_{12}, µg	5.5	11.2	4.5	6.0	2.8	2.4	3.1	3.3	2	2.5
	Ascorbic ac., mg	68.0	54.9	95.2	58.7	79.5	52.2	81.4	54.8	90	80
	Vitamin D, µg	n.e.		n.e.		1.9	1.1	2.0	1.0	5-6	5
	Folate, µg	n.e.		n.e.		131.0	46.9	130.4	50.0	200	200[4]
	Pantothenic ac., mg	n.e.		n.e.		3.1	1.1	3.2	1.0	5	6
	Biotin, µg	n.e.		n.e.		25.8	8.1	26.7	10.3	n.e.	50
Altogether	Carotenoids, mg	n.e.		n.e.		2.3	2.0[1]	2.9	2.0[1]		
	Retinol equ., mg	n.e.		n.e.		0.9	0.9	0.8	0.8		
	Vitamin E equ., mg	n.e.		n.e.		14.7	5.4	15.8	5.5		
	Thiamin, mg	n.e.		n.e.		1.0	0.3	1.0	0.3		
	Riboflavin, mg	n.e.		n.e.		1.3	0.5	1.3	0.4		

Table 12. Continued

		1S		2S		3S		4S		Hung. recom.[2]	EU RDA[3]
		Mean	SD	Mean	SD	Mean	SD	Mean	SD		
	Vitamin B_6, mg	n.e.		n.e.		1.7	0.5	1.8	0.6		
	Niacin equ., mg	n.e.		n.e.		33.8	9.5	35.6	10.7		
	Vitamin B_{12}, µg	n.e.		n.e.		3.3	2.7	3.2	2.7		
	Ascorbic ac., mg	n.e.		n.e.		79.1	51.2	88.8	61.3		
	Vitamin D, µg	n.e.		n.e.		2.0	1.1	2.3	1.3		
	Folate, µg	n.e.		n.e.		139.3	50.4	144.6	57.6		
	Pantothenic ac., mg	n.e.		n.e.		3.4	1.2	3.7	1.4		
	Biotin, µg	n.e.		n.e.		28.1	8.9	29.4	10.1		

[1] β-carotene
[2] Recommended dietary intakes in Hungary (Antal, 2005)
[3] EU Recommended Dietary Allowances (EU RDA, 2008)
[4] Folic acid
[5] It depends on age

Table 13. Average daily intake of macroelements

		1S		2S		3S		4S		Hung. recom.[1]	EU RDA[2]
		Mean	SD	Mean	SD	Mean	SD	Mean	SD		
Male	Sodium, g	8.0	2.7	8.9	2.9	7.3	1.7	7.1	1.9	2[3]	n.e.
	Potassium, g	3.1	1.0	3.3	0.9	3.0	0.9	3.1	0.8	3.5	2.0
	Na/K, g/g	2.7	0.8	2.8	0.8	2.5	0.6	2.4	0.6	n.e.	n.e.
	Calcium, mg	690.7	470.9	729.9	398.3	716.5	0.3	700.7	319.4	800–1000[4]	800
	Phosphorus, g	n.e.		n.e.		1.3	318.6	1.3	0.3	0.62–0.775[4]	0.7
	Magnesium, mg	387.0	133.3	444.1	124.0	441.5	116.6	456.8	125.7	350	375
Female	Sodium, g	6.2	2.1	6.3	2.0	5.6	1.8	5.1	1.3	2[3]	n.e.
	Potassium, g	2.6	0.8	2.7	0.7	2.7	1.1	2.6	0.6	3.5	2.0
	Na/K, g/g	2.5	0.7	2.4	0.7	2.2	0.6	2.0	0.5	n.e.	n.e.
	Calcium, mg	593.9	355.8	594.0	281.1	655.8	275.5	650.7	271.8	800–1000[4]	800
	Phosphorus, g	n.e.		n.e.		1.0	0.3	1.0	0.2	0.62–0.775[4]	0.7
	Magnesium, mg	309.0	95.0	327.9	92.1	372.4	99.9	369.1	92.6	300	375

Table 13. Continued

		1S		2S		3S		4S		Hung. recom.[1]	EU RDA[2]
		Mean	SD	Mean	SD	Mean	SD	Mean	SD		
Altogether	Sodium, g	n.e.		n.e.		6.3	1.9	6.0	1.9		
	Potassium, g	n.e.		n.e.		2.8	1.0	2.8	0.7		
	Na/K, g/g	n.e.		n.e.		2.3	0.6	2.2	0.6		
	Calcium, mg	n.e.		n.e.		680.1	294.9	672.8	294.8		
	Phosphorus, g	n.e.		n.e.		1.1	0.3	1.2	0.3		
	Magnesium, mg	n.e.		n.e.		400.1	112.1	407.9	116.9		

[1] Recommended dietary intakes in Hungary (Antal, 2005)
[2] EU Recommended Dietary Allowances (EU RDA, 2008)
[3] Utmost intake
[4] It depends on age

2.2.2.3. Microelements. In the field of microelements several difficulties arise (Table 14). The iron intake of males meets the Hungarian RDI (Antal, 2005) but does not fill the EU RDA (2008) in 3S and 4S. According to the results of each survey the iron intake in females does not reach the recommended amount. A similar pattern is found in the case of zinc and copper intake of females, by the last one in 3S and 4S only. The manganese intake meets the Hungarian RDI but does not the EU RDA. Regarding the EU RDA the chromium intakes fill the requirements but does not the much higher Hungarian RDI. (Its revision may require consideration.)

Table 14. Average daily microelement intake

		1S		2S		3S		4S		Hung. recom.[1]	EU RDA[2]
		Mean	SD	Mean	SD	Mean	SD	Mean	SD		
Male	Iron, mg	14.4	5.6	14.9	5.5	12.5	3.4	12.6	3.4	10	14
	Zinc, mg	11.5	4.6	12.3	4.1	10.2	2.8	10.2	3.0	10	10
	Copper, mg	3.1	3.4	2.9	2.6	1.4	0.9	1.2	0.4	1.1	1.0
	Manganese, mg	n.e.		n.e.		3.0	7.9	2.8	5.3	4	2
	Chromium, µg	n.e.		n.e.		74.2	29.7	65.4	27.0	120	40
Female	Iron, mg	11.7	4.3	11.0	3.7	9.8	2.6	9.6	2.4	15-8[3]	14
	Zinc, mg	8.7	3.5	8.7	3.0	7.8	2.2	7.5	2.0	9	10
	Copper, mg	2.4	2.7	1.8	1.8	1.0	0.5	0.9	0.3	1.1	1.0
	Manganese, mg	n.e.		n.e.		2.5	8.0	2.2	3.8	4	2
	Chromium, µg	n.e.		n.e.		61.3	24.1	55.0	22.7	120	40

Table 14. Continued

		1S		2S		3S		4S		Hung. recom.[1]	EU RDA[2]
		Mean	SD	Mean	SD	Mean	SD	Mean	SD		
Altogether	Iron, mg	n.e.		n.e.		10.9	3.2	10.9	3.2		
	Zinc, mg	n.e.		n.e.		8.8	2.7	8.7	2.8		
	Copper, mg	n.e.		n.e.		1.1	0.7	1.0	0.4		
	Manganese, mg	n.e.		n.e.		2.7	7.9	2.5	4.1		
	Chromium, µg	n.e.		n.e.		66.1	27.1	60.0	25.1		

[1] Recommended dietary intakes in Hungary (ANTAL, 2005)
[2] EU Recommended Dietary Allowances (EU RDA, 2008)
[3] It depends on age

3. Discussion

The four nutrition surveys carried out in the last quarter of century provide comprehensive information on the nutritional characteristics and the anthropometric approach (BMI) to the nutritional status of the Hungarian population. They revealed the dietary pattern, the most important diet-related risk factors and – in some extent – the relationships between nutrition and health conditions. Together with the application of food consumption and vital statistical data of HCSA, the surveys have open a large way for promoting health status foremost in the vulnerable and endangered groups of high risk and then in the whole population. The following milestones leap to the eye on this way:

– energy intake over the requirements (practically no changes);
– low share of plant proteins (slightly positive tendency);
– high (but decreasing) total fat intake, unfavourable (but improving) fatty acid composition;
– high cholesterol intake;
– low complex carbohydrate intake;
– high sodium intake;
– low intake of some micronutrients, especially in females (e.g. iron, zinc, calcium, folate);
– high proportion of overweight and obesity.

There are some signs of improvement, e.g. the average intake of total fat, and chiefly the saturated fatty acids, moreover that of added sugar have lessened.

These aspects naturally should be complemented by the issues of healthy lifestyle, including an adequate physical activity. The monitoring of population's health condition is needed.

The comparison of four surveys revealed that the growing epidemic of obesity could not directly related to the energy intake since it has not increased during the period studied. It could not be connected even to the added sugar or fat because the consumption of both macronutrients went rather down. The reduced physical activity and the improper eating habits jointly with unhealthy diet may bear the responsibility for this phenomenon.

The targets for further improvement may be realized by complex means:
– proper nutritional training in the schools;
– nutritional education of adult population;
– sufficient information for the consumers about the nutritional particularity of foods
– food science research including the role of changed eating habits and highly refined food products for the sake of foods providing more optimal option for balanced nutrition;
– adequate food supply in all regions;
– additional reduction of total fat intake;
– a reasonable improvement of vitamin sources (mainly in the case of deficient vitamins);
– a radical reduction of salting in food industry and households;
– a reasonable exploitation of macro- and microelement sources;
– promotion of dairy products with nutritionally favourable composition;
– promotion of vegetables and fruit consumption;
– tracing the health condition of the population, its continuous evaluation;
– identification of measures needed for correction, their implementation;
– the essential synergy of physical activity must be emphasized.

Coordinated and government-supported planning, identification of measures, likewise their implementation and continuous evaluation seem to be essential.

Everyone should learn lessons from the past for a well-founded future.

References

Antal, M. (2005): Tápanyagszükséglet. (Nutrient requirements). -in: Rodler, I. (Ed): *Új tápanyagtáblázat*. (New *food composition tables)*. Medicina. Budapest: pp 19–70.

Biró, Gy. (Ed.) (1992a): *Az első magyarországi reprezentatív táplálkozási vizsgálat (1985–1988) eredményei,* I. kötet. (First Hungarian Representative Nutrition Survey 1985–1988) Budapest: Vol. I. OTH, NEI, OÉTI. Budapest.

Biró, Gy. (1992b): Nutrition and cardiovascular risk in Hungary. -in Somogyi, J.C., Biró, Gy. & Hötzel, D. (Eds.): *Nutrition and cardiovascular risks***.** Karger, Basel. pp 1–9.

Biró, Gy. (1994a): Première enquête nutritionelle hongroise nationale. *Méd. et Nutr., 30*, 233–238.

Biró, Gy. (1994b): Results of the first Hungarian representative nutrition survey. Intake of major nutrients and nutritional status of population. -in: Somogyi, J.C., Elmadfa, I. & Walter, P. (Eds): *New aspects of nutritional status*. Karger, Basel pp 169–173.

Biró, Gy. (1994c): Az Első Magyar Reprezentatív Táplálkozási Vizsgálat: az eredmények áttekintése. (The first Hungarian representative nutrition survey: Review of results). **.** *Népegészségügy, 75*, 129–133.

Biró, Gy. (1996): Cardiovascular risk factors distribution in Hungarian adults. *Acta Cardiol, 51*, 113–128.

Biró, Gy. (1997): Nutrition trends in the eighties and nineties. *BNF Nutr Bull, 22*, 56–60.

Biró, Gy. & Lindner, K. (Eds) (1988): *Tápanyagtáblázat*. (Food composition tables.) 11th ed., Medicina, Budapest.

Biró, Gy., Antal, M. & Zajkás, G. (1996): Nutrition survey of the Hungarian population in a randomized trial between 1992–1994. *Eur. J. Clin. Nutr., 50*, 201–208.

Biró, L., Szeitz-Szabó, M., Biró, Gy. & Sali, J. (2011): Dietary survey in Hungary, 2009. Part II. Vitamins, macro- and microelements. *Acta Alimentaria, 40*, 301–312.

Biró, L., Zajkás, G., Greiner, E., Szórád, I., Varga, A., Domonokos, A., Ágoston, H., Balázs, A., Mozsáry, E., Vitrai, J., Hermann, D., Boros, J., Németh, R., Kéki, Zs. & Martos, É. (2007): Táplálkozási vizsgálat Magyarországon, 2003–2004. Mikrotápanyagok: ásványi sók. (Hungarian national dietary survey, 2003-2004: Micronutrients: minerals). *Orvosi Hetilap, 148*, 703–708.

Central Statistical Office (1986): Statistical yearbook of Hungary. 1985. KSH, Budapest.

Central Statistical Office (1991): Statistical yearbook of Hungary. 1990. KSH, Budapest.

Central Statistical Office (1996): Statistical yearbook of Hungary. 1995. KSH, Budapest.

Central Statistical Office (2001): Statistical yearbook of Hungary. 2000. KSH, Budapest.

Central Statistical Office (2003): Statistical yearbook of Hungary. 2002. KSH, Budapest.

Central Statistical Office (2005): Statistical yearbook of Hungary. 2004. KSH, Budapest.
Central Statistical Office (2008): Statistical yearbook of Hungary. 2007. KSH, Budapest.
Central Statistical Office (2009): Statistical yearbook of Hungary. 2008. KSH, Budapest.
EURDA (2008): Recommended Dietary Allowances. In *Richtlinie 2008/100/EG* der Kommission vom 28. Oktober 2008 zur Änderung der Richtlinie 90/496/EWG des Rates über die Nährwertkennzeichnung von Lebensmitteln hinsichtlich der empfohlenen Tagesdosen, der Umrechnungsfaktoren für den Energiewert und der Definitionen. EUR-Lex-32008L0100-Rodler, I., Biró, L., Greiner, E., Zajkás, G., Szórád, I., Varga, A., Domonkos, A., Ágoston, H., Balázs, A., Mozsáry, E., Vitrai, J., Hermann, D., Boros, J., Németh, R. & Kéki, ZS. (2005): Táplálkozási vizsgálat Magyarországon, 2003–2004.. (Hungarian national dietary survey, 2003-2004). *Orvosi Hetilap, 146*, 1781–1789.
Szeitz-Szabó, M., Biró, L., Biró, Gy. & Sali, J. (2011): Dietary survey in Hungary, 2009. Part I. Macronutrients, alcohol, caffeine, fibre. *Acta Alimentaria, 40*, 142–152.
WHO (1988): *Report on a WHO consultation on the epidemiology of obesity: Measuring obesity. Classification and description of anthropometric data*. WHO Regional Office for Europe, Nutrition Unit, Copenhagen
WHO (2000): *Report of a WHO Consultation*. *Obesity preventing and managing the global epidemic***.** WHO Technical Report Series 894. WHO, Geneva.
WHO (2003): *Report of a joint WHO/FAO expert consultation*: *Diet, nutrition and the prevention of chronic diseases.* WHO, Geneva.
Zajkás, G., Biró, L., Greiner, E., Szórád, I., Ágoston, H., Balázs, A., Vitrai, J., Hermann, D., Boros, J., Németh, R., Kéki, Zs. & Martos, É. (2007): Táplálkozási vizsgálat Magyarországon: Vitaminok. (Dietary survey in Hungary. Micronutrients: vitamins). *Orvosi Hetilap, 148*, 1593–1600.