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Review

Nutritional Studies in Croatia – A Century of Research

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A B S T R A C T

This paper is dedicated to the pioneers of nutritional research in Croatia: to Professor Edvin Ferber, Professor Hubert Maver and Professor Ratko Buzina, to whom we owe exceptional contribution in the development of science of nutrition, as well as for many scientific publications from the fifties to the eighties in the 20th century, leaving us great information about nutritional state in Croatian population. The paper brings a review of nuitritional research in Croatia with an emphasis on history of research and papers published in Collegium Antropologicum. Since first publications on the subject, a number of institutions and scholars participated in numerous research projects which resulted in a vast number of published papers, depicting a multidisciplinary approach to the subject. In addition, the results of 44 analyses that have been a part of doctoral (18) and master's research (26) are discussed.

Key words: *nutritional research, anthropological history, Croatia, literature review*

History of Nutritional Research

Through civilizational history, man has been experiencing many processes, in which he has been creating nutritional habits in a constant fight against hunger, social and civilizational differences, so today we can regard nutrition as a part of the culture of each nation and individual, as well as a fundamental factor in watching health and fighting against diseases. The history of nutritional research has started in old Greece with Hippocrates (460–370 B.C.) (Figure 1), who was the first one who realized the importance of nutrition for good health and against diseases.

Erasistratus (330?–250? B.C.) was the first one who experienced with metabolism, and only after a long period, Galen (129–200 AD) (Figure 2) showed scientific interest for nutrition science. Many centuries have passed until the physicist Santorius Koperski (1561–1636) improved nutrition science. Subsequent development of nutrition science was continued by John Mayow (1641–1679), an English physicist, whose research was based on the investigation of the work of muscles and their connection with burning out of some substances that were unknown to him. In 1753, James Lind (Figure 3) made a famous experiment on twelve sailors suffering from scurvy, and he found out that orange and lemon had positive effects on curing that disease.

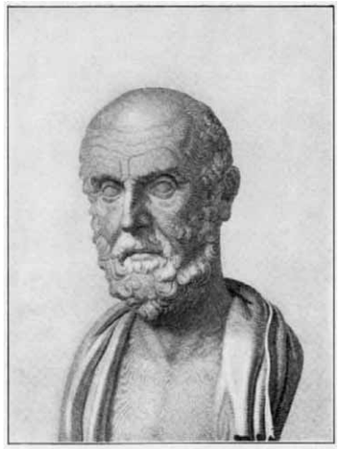

Fig. 1. Hippocras (460–370 BC).

Antoine L. Lavoisier (1743–1804) (Figure 4), a French chemist, was the first one who discovered the process of oxidation in metabolic decomposition of food, and was acknowledged as an establisher of modern nutrition sci-

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Fig. 2. Galen (129–199 BC).

LAVOISIER.

Fig. 4. Antoine L. Lavoisier (1743–1804).

Fig. 3. James Lind.

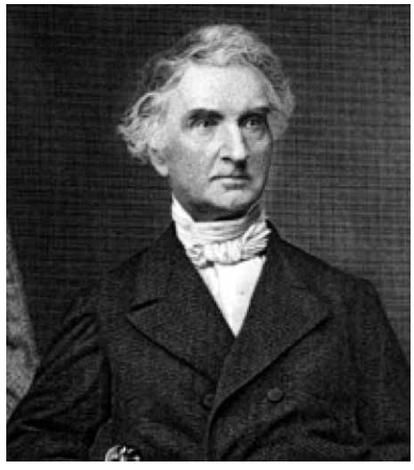

Fig. 5. Justus Liebig (1803–1873).

ence. William Prout (1785–1873) discovered hydrochloric acid in stomach, and found out that man is composed of proteins, hydrocarbons and fats, so he concluded that man must take a daily dose of these compounds.

Justus Liebig (1803–1873) (Figure 5) showed that human body consists of three types of organic substance liable to oxidizing processes. Much credit goes to Max Rubner (1853–1932) (Figure 6) for the development of nutrition science in the 19th century, as he was the first one who evaluated caloric values of proteins, hydrocarbons and fats, after the first calorimeter had been invented by an English scientist Atwater in 1832. Emil Fishere (1832–1919) explained the synthesis of proteins and hydrocarbons, and together with Frederik Hopkins (1861–1947), defined the primary role of amino acid as a component of proteins. The term »Vitamins« was introduced by Kazimir Funk, although Japanese officer Takaki and Christian Eijkman had been already engaged in the concept of vitamins.

Outstanding research on the development of digestive physiology was carried out by Claude Bernard (1813–1878) and Ivan Petrović Pavlov (1849–1936). Herman Helmholtz (1821–1894) confirmed transmission of energy during the work of muscles. Quick development of nutrition science in the 20th century is indebted to great scientific discoveries like X rays, radioisotopes, ultrasonography, magnetic resonance and modern biochemistry, up to genetics, molecular biology and immunology, on which principles was researched the nutritive influence on health and various diseases. Today we must point out the importance of multidiscipline, where we could have nutritionists, medical doctors, anthropologists, food technologists, veterinarians, agronomists, biologists etc, all of them in an ideal investigating team[1–4].

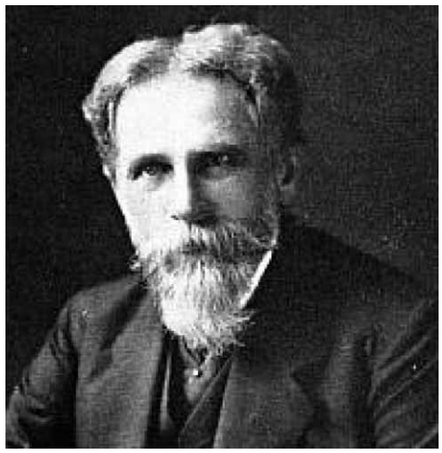

Fig. 6. Max Rubner (1853–1932).

Biomedical Nutritive Research

Biomedical nutritive research might be different: 1) directly connected with nutritive factors and the way they influence different aspects of biology or ecology of human population, or 2) they might be connected with man's nutritive adaptation.

Nutritive studies are defined through the research of various other studies, like nutritive, biochemical, anthropometric and clinical studies, with the aim of defining health state of an individual or the whole population. Apart from defining health state, nutritive studies can be very useful to anthropologists, even for research of human adaptability that is reaction on various physical, cultural and environmental stresses. The main questions imposed on anthropologists – nutritionists are: malnutrition, lack of specific nutriments, fatness related to different populations, socio-economic status, preservation of species, ecology of a disease and its connection with nutrition and nutritive status, sensitivity to infectious diseases, as well as to the children's growth and development. The methods accessible to nutritionist research can be divided into two main types: those concerned directly with food consumption and those concerned with nutritional status of an individual or a population. For the first type of research, the most important thing are figures about nutritional habits of various social sectors, the differences in nourishment during the season, age, sex or reproductive status. The methods of the first type of research are: 24 hours recall, estimated food record, weighed food record and food frequency questionnaires. Such researches are liable to a mistake, that's why they are mostly combined with the researches of the second type. The second type of research is based on anthropometry, defining composition of the body, biochemical, immunological and clinical methods. The most widespread researches are anthropometric, because of their simplicity and moderate expenses, and the most widespread measure is relative weight, which denotes the percentage of deviation from standard values for certain age, sex and height. The anthropometry is enough for measuring children, but there are two essential variables for classification of adults, both recommended by Ferro-Luzi and Waterlow, one for determining the mass of the body, BMI (body mass index, weight divided with height), and another one for determining the level of physical activity, PAL (total daily energy expenditure divided by basal metabolic rate). The measure of body composition is useful for evaluation of fatness and thinness, and measures of skin wrinkles are mostly used for this method. Biochemical tests are one of the essential indicators of nutritive state. Plasma albumin tests are mostly used from the wide range of such tests, and we use them to get results about nutritive state of proteins and hemoglobin, used for measuring the quantity of ferro-B-complex, ascorbic acid, copper and cobalt. Biochemical tests are also used for measuring nutrients in body fluids and tissues, which includes urine, hair, sperm, nails and skin. Immunological tests measure ability of strengthening immunological system on certain antigenetic stimuli, and weakening of immunological reaction is mostly combination of stress, lack of nutrients and infectious diseases. Clinical researches are used in detecting already serious nutritive deformations, so they are based on examining skin, eyes, hair, mouth, parathyroid and thyroid gland. Nutritive researches are the basis for making schemes, and the first one was made by »Food and Nutritional Board«, American academy of science in 1940, with recommendations that should be guidelines for regular planning of nourishment[5–8].

Socio-Culture of Nutritive Research

Socio-cultural researches include description and history of nutritive habits. Researches of socio-cultural type investigate nutritive habits in a cultural environment, and introduce us to the symbolic meaning of food in certain regions. Socio-cultural researches include history and description of nutritive habits, as well as nutritive behavior within a cultural group. These researches describe nutritive habits in certain cultural environment, and they give detailed description of preparing and serving traditional dishes. Croatia is definitely very interesting for such researches, because of great varieties of regional characteristics[9]. As an example of such researches we can point out investigations of traditional nourishment of the island Pašman[10], homesteads in Dalmatia[11], country nourishment in Baranja[12], Žumberk[13] and Cres[14], as well as cultural description of nourishment in different parts of Croatia[15]. In 1984 and 1989, Lazarević[16,17] introduced in her researches necessity for multidiscipline nutritive study, in other words, she introduced cooperation between cultural anthropologists and nutritionists, while Škreblin and Sujoldžić conducted researches of multidisciplinary type in 2002[18].

Nutrition Science in Croatia

In order to understand the possibilities and necessities of anthropological and nutritional researches in Cro-

atia, it is necessary to take into consideration its geo--strategic position, but we must not forget that a certain level of nourishment of one population is reflection of its economical and cultural status, which unfortunately was never at high level in Croatia. Specific position of Croatia, variety of its relief and climatic regions, as well as vegetarian varieties on a relatively small area, enabled wide and diverse choice of nourishment to its population[2].

When it comes to nutritional research in Croatian anthropology, we owe much to the medical doctors, who, in their daily practice, encountered various problems and diseases caused by malnutrition and dietary practices. First publications that deal with nutritional studies of Croatian populations are those of Mašek (1899), followed by studies of Mayerhofer (Figure 7), Lederer, Mikić and others at the beginning of the 20th century. Of great interest are books by Bogić (1927) in which he described the dietary practices of inhabitants of various regions of the former Yugoslavia, Grossmann's book (1934) in which we can find figures about necessary weights for certain age, as well as caloric and composing tables for certain nourishing food, and »The nutritional lexicon« by Mayerhofer (1944)[19–25].

The first institution in Croatia, which was dealing with nutrition science, was founded within Institute for Hygiene by Professor Edvin Ferber after the Second World War. Owing to Professor Ferber, Professor Buzina from Institute for Hygiene and Professor Hubert Maver from Institute for preventive medicine of former Yugoslav army, many important publications were made during the period from ž50s to ž80s. In 1984, the branch of nutrition science was founded on University of food and biotechnology in Zagreb, and even today it has great importance in educating young nutritionists.

The most important institutions that investigate anthropological-nutritive researches in Croatia today are: Croatian Institute for public health, that is department for physiology, observing and developing nutrition, headed by Zrinka Petrović, Institute for knowledge and control of raw materials and nutritive products, that is laboratory for the chemistry of food, belonging to University for food science and biotechnology in Zagreb, headed by Irena Colić-Barić, and Institute for testing food and control of quality of nutritive products, belonging to University for food science in Osijek, headed by Milena Mandić[2].

Fig. 7. Ernest Mayerhoher.

Researches in Croatia up to 1960

Although extensive nutritive researches in Croatia started only after the Second World War, as it has been already said, the first published writings of nutritive anthropological researches in Croatia date from 1899. That was the year when Mašek described two cases of pellagra. Not only the description of the history of disease, but also the description of the country nourishment of that time was very interesting. »The food of the patients was the simple country food like: bread, hardboiled corn mush, beans, corn mush fried with eggs and cheese. There were neither milk or alcohol in the house and they had meat only for Christmas, New Year, Epiphany and for Carnival«. In 1903 Lederer described the treatment of anemia. I will mention several interesting quotations from that article: »There are still doctors who oppose to the aim of necessity of blood letting« or »when a young doctor, after just graduating from college, starts his practice, he comes very often to the situation, especially in the country, to cut his veins. The same thing happened to me. Only after starting my practice, I had to let my blood very often, and to be quite honest, I was forced to do it«. Mayerhofer, who described food prices in Zagreb in 1924, recognized social sensibility, that is, the importance of the prices of food articles in the nourishment of the whole population. It is interesting to see the relationship of prices between some foodstuffs (the prices are expressed in the then dinars): 1 l of milk – 3.5 d, 1 kg of cheese 3.5 d, 1 egg – 1.37 d, cherries – 10.25 d, 1 kg pork meat – 29 d, 1 kg of peas – 9.35 d etc. Although the prices were said to be too high, the average income of that time population was not mentioned.

One of the most analyzed nutritive problems in ž30s, especially in the continental part of Croatia, was rickets. Mašek published the figure about great extend of rickets in the temperate climate, and he alleged that we could find in towns even 90% of »proletarian« children and 60% of children of »rich class« who suffer from rickets. In 1935, Dragišić discovered, by the means of clinical researches, great frequency of rickets, more than 90 % of country children, and he compared duration of lactation with the appearance of rickets. Dragišić brought out the figures of 1002 rickety children, 103 of them were artificially fed from the first day, 360 were artificially fed from 1 to 6 months, 492 were artificially fed from 6 to 48 months, while 47 children had unknown cause. After the Second World War, 7,654 cases of rickets were registered in 1950, and 9014 cases in 1951. Researches, made by

Buzina in 1952, discovered an extremely great appearance of rickets in Croatian villages around Zagreb 85.1%, Sisak 79.4%, Sinj 74.8%, Karlovac 72.1%, Slavonska Požega 68.3%, Split 64.3%, Rijeka 63.6%, Varaždin 62.6%, Ogulin 60.4% and Gospić 52.4%. The author attributes the great percentage of rickets not only to the lack of vitamin D, but also to very bad hygienic conditions in the villages. According to the lack of vitamin D, in 1954, Maver discovered the appearance of rickets in school children, 44.78 % of boys and 25.18 % of girls[19–21,26–30].

The great problem regarding health and nutrition, which according to some suppositions has existed in Croatia from the middle ages, is the lack of iodine, which causes goiter. Goiter was mostly widespread in the continental parts of Croatia, especially in some parts of Posavina and Podravina, the regions of endemic goiter, and the village of Rude, near Zagreb, where in the early ž50s; the frequency among school children was around 85% (Table 1). Goiter is determined by researches of school children and youth, because they are the best indicator of momentarily state in population, as the adults have goiter usually because the lack of iodine in the past. Daily man's necessities for iodine are 150–300μg, and reduced taking can cause troubles like reduced fertility, increased frequency of abortions, innate anomalies etc, and in the regions of striking lack of iodine, we can find even endemic cretinism. By the study from 1955, Buzina has analyzed iodine in Croatian waters, and conducted clinical researches of the population who have been using this water. The results about goiter in the villages in Savska Banovina (15446 goitred persons or 6.9%) were used in these investigations. As a conclusion, we can mention negative correlation between the quantity of iodine in drinking water and the mortality rate, caused by goiter. Researches carried out by Prebeg about extension of goiter and wide influence on psychophysical state, were realized on the sample of 19439 children in Zagreb and its environment at the end of 1953 and in 1954. From the total number of examined children, it was discovered that 9,033 children suffered from goiter, that is 46.5%, which was much more than 15.7%, evidenced by Ferber in 1951. For the sake of comparison, such frequency of goiter among school children was discovered in Lussan, Switzerland, in 1923. The results of investigations are also shown by the relationships between certain parameters, which discovered that the girls have more goiter than the boys in proportion to 50.9% – 42.2%. It was also found out that the illness doesn't depend on the age and the relationship between physical development and goiter, which showed that taller and overweight children are much more inclined to the illness. Researches of the influence of illness on learning showed that children with worse abilities are more liable to the illness. There are no differences in extension of goiter between country and town people, and neither are in altitude difference of dwelling[22,31–34].

According to clinical researches, Maver has conducted investigation about the state of well-fed persons on the sample of 2,443 school children in Zagreb in mid 1950s.

TABLE 1
FREQUENCY OF GOITER, MEASURED IN CROATIAN COUNTIES AT THE BEGINING OF ´90s (AFTER KUSIĆ[31])

Place	Number of examined children		% of goiter	
	7–11 years	12–15 years	7–11 years	12–15 years
Zagreb	379	361	20	19
Rude	88	112	26	43
Osiječko-Baranjska county				
Osijek	123	122	29	27
Vuka	102	101	23	37
Primorsko-Goranska county				
Rijeka	198	269	12	14
Delnice	100	101	18	33
Splitsko-Dalmatinska county				
Split	96	109	6	10
Lovreć	76	99	14	13

Although no lack of vitamins was discovered, there were some sub clinical signs of shortage, 14.54% of boys and 26.66% of girls showed the symptoms of lack of vitamin A, and 1.05% of boys and 4.43% of girls showed the signs of deficiency of riboflavin[30].

By clinical and laboratory examinations, Buzina determined the quantity and quality of nourishment of 42 pupils. The results showed that caloric value of food satisfied daily needs, as well as the quantity of daily taking of fat and proteins, while the quantity of taking of riboflavin was 31% less than recommended daily quantity. The results, achieved on the basis of index of height and body weight, showed good physical development and state of well-fed persons, without signs of malnutrition. Research of well-fed persons of the whole population in Croatia was carried out by Ferber and collaborators, as well as by Maver and Ferber at interval of several years. Nutritive survey of 250 homesteads was carried out by Ferber and collaborators in 1952 (Table 2), when they reached a conclusion about qualitative and quantitative scarce nourishment. In 1954, 64 villages with 1,200 homesteads in 12 different parts of the country and with 3,010 examined children, were tested and treated, and the results showed deficiency of vitamins A, D, C and riboflavin.

In the analysis of nourishment in five towns in Croatia (Zagreb, Rijeka, Split, Osijek and Varaždin), anthropometric measurements, clinical controls and biochemical analysis were carried out on totally 11,294 citizens. Researches showed great qualitative and quantitative deficiency in nourishment, especially deficiency of vitamin A, riboflavin, ascorbic acid and calcium. Comparing researches from 1954 on country people with researches from 1956 on town people, it was discovered that the greatest differences in taking certain nutritive were in

TABLE 2
DAILY CONSUMPTION OF CALORIES, PROTEINS, FATS AND CARBOHYDRATES PER HEAD FROM 1952 (AFTER FERBER[36])

Region	Calories		Proteins		Fats		Carbohydrates	
	Town	Village	Town	Village	Town	Village	Town	Village
Rijeka	2518	2421	75.22	72.97	78.71	59.08	361.83	367
Split	2413	2263	72.87	68.66	77.34	62.34	381.49	315
Varaždin	2670	2264	83.96	74.9	96.38	59.27	358.63	334
Zagreb	2554	2338	74.60	77.26	88.46	58.93	355.70	346

TABLE 3
SLAVONIA / DALMATIA – FAMILY, AUTUMN 1958 – DAILY TAKING UP PER HEAD OF POPULATION, MEASURED IN 25 FAMILIES IN SLAVONIA AND 24 IN DALMATIA (AFTER BUZINA[40])

	Unit of measurement	Slavonia	Dalmatia	Δ	t
Calories		3,331±137	2,869±122	462	2.52
Proteins	g	104±4	82±3	22	3.79
Fats	g	93±7	97±7	4	0.39
Carbohydrates	g	445±27	353±14	92	3.02
Alcohol	g	42±2	36±2	6	2
Vitamin A	I.U.	3,152±479	5,180±1,057	2,028	1.78
Thiamine	mg	1.7±0.1	1±0.1	0.7	5.38
Riboflavin	mg	1.4±0.1	1.1±0.1	0.3	1.86
Niacin	mg	24±1	18±1	6	2.96
C vitamin	mg	135±9	122±18	13	0.83
Calcium	mg	626±45	524±63	102	1.32
Iron	mg	40±5	25±2	15	2.66

Split, which had the biggest value of vitamin A with 4,150 I.U., unlike the villages from the same region, which showed the lowest values with 930 I.U. Riboflavin and calcium were deficient in the village, while consuming of thiamine and niacin was within normal limits, both in the village and in the town[35–39].

Joining clinical, anthropometric and laboratory tests, Buzina and his collaborators (Table 3) initiated more intensive field researches in three regions of Croatia that differs in used fats. The chosen regions were Dalj in Slavonija, the region with mostly used animal fat, villages near Šibenik in Dalmatinska zagora – Boraje, Lepenica and Vrsno, the region in which people use both, animal fat and vegetable oil, and Sali on Dugi island, the region in which people use nearly only olive oil. Researches consisted of anthropometric measurements of body weight, skeleton, relative malnutrition and fatness, height, skin wrinkles and biochemical analysis. Statistic results of these investigations showed significant linear age trend of cholesterol in blood, and at a specific age (19–59) there wasn't much deviating from linearity. The value of cholesterol in blood for age set values was in proportion to 239mg/100ml (animal fat), 211mg/100ml (vegetable oil and animal fat), 201mg/100ml (olive oil)[40–42].

According to the great influence of economical situation on the nourishment of population in that time, we must mention Ferber's analysis carried out on 227 families in Zagreb, in which he compared the prices of food, personal income and energy taking up (Table 4). It was discovered that people were buying food of higher energy importance and that expenses for food were inadequate to incomes[43].

Researches in Croatia from 1960–1970

From the review of nutritive state from 1960s, represented by Ferber, we can see rather bad socio-economical situation of nourishment, like deficient dairy food, for example in Zagreb, around 100,000 l of milk was daily used, that is only 15g per head. Milk consumption of preschool and school children could be seen according to the figures about milk kitchens in schools, whose number was 3,200 in 1965, and they were used by 595,658 pupils, while significant decrease was evident in 1967, when we had only 660 kitchens with 226,908 pupils. Except of shortage of milk, meat consumption was also decreased because of high prices, and consumption of sea fish was around 0.5 kg per head yearly, what is below all world averages, which were around 17 kg per head at that time. That was the period with food too rich with carbohydrates and poor with proteins and vegetable oil, because of which there was deficiency of vitamins D, A, B2 and C[44].

TABLE 4
CONSUMPTION OF NOURISHING PRODUCTS, ACCORDING TO THE SURVEY OF POPULATION FROM 1958 (AFTER FERBER[43])

Food	Per head daily – grammas	Per head yearly – kilogrammas
Bread	312.8	114.172
Corn bread	0.08	0.029
Bread grains	115.85	42.285
Vegetables	108.46	39.587
Beans	26.18	9.555
Potatoes	142.65	52.067
Fruit	75.17	27.437
Jam	16.48	6.015
Honey	0.98	0.357
Fruit juice	0.61	0.222
Meat	86.73	31.656
Fish	10.69	3.901
Milk	224.77	89.341
Powdered milk	0.19	0.069
Dairy products	12.01	6.938
Eggs	0.35	0.127
Fat	58.89	21.494
Sugar	45.77	19.706
Chocolate, candy	1.45	0.529
Wine	19.49	7.113
Brandy	4.31	1.573

In 1958, Buzina and collaborators started a long – term and complex research in Slavonia and Dalmatia, which was continued in 1960, 1961, 1962 and 1963, in order to cover all seasons (Table 5). These researches were at the same time part of famous Keys's researches, which were carried out in seven countries (Greece, Yugoslavia, Italy, Finland, Netherlands, USA and Japan), and within Croatia, researches were carried out in Dalmatia and Slavonia.

The samples of 1,363 persons were taken in six places near Makarska; Puharići, Gornji Tučepi, Gornja Podgora, Donja Podgora, Drvenik and Gradac in Dalmatia, and in Dalj in Slavonija. Research methods of the state of nutrition were based on gathering nourishing figures in each family during seven days. Food, including drink, was measured and converted into caloric values by the means of nutritive tables. The annex to more precise calculating of caloric values of nutritive food was given by Brodarec, who by the means of chemical analysis of food, made local tables of caloric values. Researches of body composition consisted of measuring of six variables: height, relative weight, skin wrinkles, systolic and diastolic pressure and concentration of cholesterol in blood. Analysis showed that there was bigger taking of calories in Slavonija, while in Dalmatia there was bigger consumption of alcohol.

The biggest differences in nourishment were in the use of fat, according to which the ratio of unsaturated and saturated fatty acids was 1:1 in Slavonija and 3:1 in Dalmatia, while the content of mono-, di- and tri unsaturated fatty acids was bigger in Dalmatia. The results of these researches were connected with blood coagulability. The group in Slavonia showed shortened coagulation, although the total consumption of fats, converted into calories, didn't show great differences between these regions, they were relatively low in both populations. Although the blood pressure was nearly the same, bigger number of hypertension was found in Slavonia. Consumption of thiamine, niacin and iron was higher in Slavonija, while consumption of other nutrition was the same in Slavonija and Dalmatia. By investigating, it was proved that higher socio-economical status was connected with bigger weight, higher blood pressure and higher level of cholesterol in blood. Brodarec pointed out to a small difference between these two populations in variables important for etiology of heart diseases, like relative body weight, systolic and diastolic blood pressure, physical activity and cholesterol. The level of cholesterol in blood serum was higher in population in Slavonia, according to statistic figures, which showed higher mortality rate of heart diseases in Slavonija than in Dalmatia. The relationship in nourishment between the head of the family and other members of the family was also investigated, and we can say that before research it was believed that the head of the family had better quality and quantity of food. The results showed irrelevant difference in quality of food, while the quantity was a bit higher in the head of the family. For the purpose of nutritive seasonal research, individual testing of the head of the family was carried out, and it was concluded that in Dalmatia there was more constant nourishment during the whole year[45–51].

The comparison of supplies with nutriments in four Croatian regions: Dalmatia (1963), Slavonija (1963), Istria (1964) and Turopolje (1965), based on clinical, laboratory and anthropometric examinations, showed enough taking of 2500 calories in Istria, and enough taking of proteins, fats and carbohydrates in all tested regions. Deficiencies of riboflavin and thiamine are found in Dalmatia and vitamin A in Istria. Although it seemed satisfactory, Buzina mentioned existence of certain differences in distribution of food within tested groups, and he warned that one part of population was handicapped.

This period is also characterized by testing the state of well fed in certain categories of population. Discovery of anemia in 208 pregnant women, which was carried out by Buzina and his collaborators, by measuring hemoglobin, hematocrit and erythrocyte, showed that 17.8% of women had anemic values of hemoglobin, bellow 10g/100 ml in blood. Although the survey of nourishment, carried out in families of tested women, showed that the consumption of iron was adequate to the standards, it was concluded that the cause of inadequate supply of iron should be searched in distribution of food in families, or in difficult absorption of iron as a result of too much consumption of carbohydrates[52, 53].

TABLE 5
MIDDLE VALUES FOR MEN, CLASSIFIED ACCORDING TO THE AGE, IN DALMATIA AND SLAVONIA, AND SHOWN AS MEDIAN, % OF AVERAGE FOR ALL 18 SAMPLES FROM 1958 (AFTER BUZINA[45])

Region	Variables	Middle values				Median, % of average			
		40–44	45–49	50–54	55–59	40–44	45–49	50–54	54–59
Dalmatia	Height (cm)	175	173	173	172	103.1	102.3	102.8	102.6
	Rel.weight (%)	94	93	90	88	95.8	96.7	94.5	93.5
	Skin wrinkles	15	15	14	13	70.8	73.5	67.6	65.3
	Syst. B.P.	136	135	137	135	103.8	101.5	100.0	96.0
	Diast. B.P.	85	80	82	82	104.9	98.3	98.3	97.3
	Serum chol.	182	185	186	188	88.2	89.2	89.0	91.0
Slavonija	Height (cm)	170	168	166	168	100.1	99.4	98.6	100.2
	Rel. weight (%)	95	94	88	91	96.8	97.7	92.4	96.7
	Skin winkles	15	15	13	14	70.8	73.5	62.8	70.4
	Syst. B.P.	130	130	131	140	99.2	97.7	95.6	99.6
	Diast. B.P.	79	80	80	84	97.5	98.3	95.9	99.6
	Serum chol.	196	197	200	194	95.0	95.0	95.7	93.9

Ferber and his collaborators made analysis of nourishment of 114 persons of older Jewish population, what was the first analysis of that type in former Yugoslavia. The lack of protein was discovered by the analysis of daily menu, as well as by chemical analysis of menu, while the consumption of fat and carbohydrates was oversupplied. Biochemical tests of blood and urine were also made in investigations, and we couldn't see any connection between nourishment, health and long life[54].

Goiter in some parts of Croatia was still great problem, in spite of introduction of one prophylaxis from 1956. The region of endemic goiter in Croatia is Podravina, and the main reason for it was carried out by Maver and his collaborators. The lack of iodine is the main cause for goiter, but there are also many other factors that influence normal absorption and integration of iodine, like vinylthiooxazalidon and vitamin A, as well as economic factors that influence bad nourishment. Investigations in two villages, Legrad and Koprivnički Ivanec, discovered good supply of iodine in both villages, although there was great increase of goiter in Legrad, between 1960 and 1965, especially in women, from 42% to 64% and in men from 27% to 34%. The number of goitred persons was rather decreased in Ivanec after 1960, 5% in men and 23% in women. Prejac and his collaborators gave figures about investigations of serum lipids among population with great frequency of goiter, which included villages in Podravina – Legrad and Đelekovac, with frequency of goiter of 30% in men and 40% in women. The results of these investigations were compared with former quoted investigations, carried out by Buzina, about taking fat in regions of Dalj and Makarska. It was found out that the portion of fat in these villages was bigger than that in Dalj and Makarska, while the quantity of cholesterol in blood was less. Such results made the authors conclude about existence of endogen, or still unknown factors that caused deviation of present norms. Determination of the influence of iodine prophylaxis was carried out by Buzina and his collaborators, ten years after its regulation. 5000 children were tested from already tested regions (Osjek, Varaždin and Bjelovar region). The results showed the decrease of goiter, supposing that the places without decrease, had other strumogen factors in food that influence high level of goiter[45,55–57].

Buzina investigates attributing of body constitution to the ethnic characteristics and genes or nourishment, by anthropological measurements, carried out in Hrvatsko zagorje, on selected population of children and youth from Pregrad, Bednja, Krapina and Zabok. In that way, Buzina got genetically identical populations, influenced by different environmental factors. It was expected before researches that genetic factors influence the growth of bone tissue much more than the development of soft tissue-muscles and fats, which are liable to the influence of ecological factors. Comparing parameters between town inhabitants in Zagorje (Krapina, Zabok), taller population who had bigger values of relative body weight, better index weight/height and better muscle built, with country inhabitants (Pregrada, Bednja), and with inhabitants from Dalmatia, there were discovered obvious tendencies in the change of skeleton. It was concluded that the build-up of skeleton in town inhabitants in Zagorje approaches to tall inhabitants from Dalmatia, which helped Buzina to show that improvement in nourishment influences parameters of physical growth and development[58].

We get a better insight in energy needs, by knowing energy expenses of inhabitants, and in that way we can better plan nourishment and physical labor of individuals and the whole population. For this purpose many authors made tables of energy expenses for certain professions. The figures of energy expenses of various professions of this period were carried out by Maver, who included in his researches bakers, miners, textile workers and bus drivers.

The methods of investigation of energy expenses were based on chronometry during the whole working time, as well as on establishments of executed works. For each job, energy equivalent was determined by the analysis of sample of breathed out air gathered in respirometer, according to Franz-Muller, while the analysis was done according to Scholander. From the results of these researches, there were visible different expenses of calories at certain jobs within some professions, like at bakers, sifting the flour 981 calories, fuelling of the stove – 2,071 calories. It was also concluded that by introducing mechanization (miners), energy expenses are essentially reduced[59–64].

Researches in Croatia from 1970–1980

This period is characterized by the researches of state of well fed in certain age groups of population in Croatia, paying most attention to children.

Researches of nutritive status of 3,622 children at the age of 4 in whole Croatia, are carried out by Buzina and his collaborators, on the sample of population in Dalmatia (Šibenik, Makarska), Slavonija (Dalj, Đakovo, Slavonski Brod, Podravska Slatina), Zagorje (Zabok, Ivanec, Krapina), Zagreb counties (Velika Gorica, Samobor) and Rijeka (Table 6,7). Anthropometric measurements showed positive trend of well fed, according to the increase of relative bodyweight, although in some populations there were still some cases of malnutrition, even bellow 90% of relative weight, and in some regions (Rijeka, Zagreb) there was great increase of relative weight, above 120%. From the height measures it was obvious that the children from Dalmatia are on average taller than in Zagorje and Slavonija. Clinical researches discovered some symptoms of nutritive deficiency. Angular stomatitis, as a consequence of the lack of riboflavin was discovered in 13.9% of children in Zagorje and 6% in Slavonija, the bleeding of gums as unspecific, but in epidemiological researches good indicator of lack of vitamin C, appeared in 10% of children in Zagorje and 5% in Slavonija and Zagreb. The appearance of xerosis and follicular hyperkeratosis as a result of the lack of vitamin A, and atrophy of papilla as a result of the lack of vitamin B complex, were very low. The most important changes were decreases of enlargement of thyroid gland, probably as a consequence of introducing of iodine prophylaxis from 1956, since when 1kg of salt has iodized with 10mg KI. Biochemical researches showed decreased values of hemoglobin, from 3% to 16%, with the biggest aberration of 16.8% in Slavonija. Low values of hemoglobin are confirmed by the results of researches, carried out by Hibšer and his collaborators, on population of pupils in Vinkovci, which show figures of 11.7% of anemia in girls and 13% in boys. High appearance of sideropenic anemia in Croatia was pointed out by Sapunar and his collaborators in Dalmatinska zagora (25%), by Donadini in Split and its surroundings (36.35% and 20%) and also in Slavonia (22%). Biochemical researches discovered vitamin deficiency of riboflavin and vitamin C. The regions with the biggest deficiencies are Zagorje and Zagreb, with the lack of riboflavin of 54% and 30%, and Rijeka with 17% lack of vitamin C. Among other important deficiencies, there is pyridoxine of 9–20%, whose diagnostic criterion was investigated by Buzina and his collaborators, on a group of 70 children. The deficiency of thiamine can be found in Rijeka and Dalmatia, ranging from 14–19%. These results showed the relationship of vitamin deficiency between country and town inhabitants, and it was clear that there was bigger deficiency in country inhabitants. There were also researches about additions of vitamin deficiency (2.5 mg riboflavin and 50 mg C-vitamin per meal) in Hrvatsko zagorje, on a sample of two groups of school population with prevalence of angular stomatitis of 17–20%, and high percentage of gums bleeding. The results showed positive effects of vitaminised meals, and discovered that adding of riboflavin for only two months is enough to achieve optimal function of enzyme glutathione reeducates, and that in interval of six months; prevalence of angular stomatitis can be significantly reduced. It is supported by the figure that prevalence of angular stomatitis was reduced on 3.4%, while in a control group it grew to 29%. Adding of C vitamin was enough to keep optimal level of ascorbic acid in plasma, but it didn't influence on gums bleeding. The author mentions that deficiency of vitamin C is mostly of seasonal nature, so the problems with deficiency start in January and last until April and May, and in September the values of C vitamin in plasma are satisfactory, because of consumption of seasonal fruit[65–70].

There was an extensive study about the state of well fed of 3,744 school boys and 5,033 school girls at the age of 7 to 19 from Zagreb, as carried out by Prebeg and his collaborators. Researches discovered mild malnutrition in 10.6% of girls and 8.8% of boys, and high overweight in 11.15% of girls and 11.6% of boys. Such results discovered a bit higher body weight in children from Zagreb, compared with European average, which according to the author, could be the »consequence of quick acceleration of growth in the last decades«[71].

The analysis of nourishment of children in Split was carried out by Marušić, and it was concluded that daily meals were 13% caloric insufficient, although anthropometric measurements showed normal fed of relative weight from 90–110%. Apart from caloric deficiency, insufficient taking of vitamin B complex was discovered by the analysis of blood. The analysis of children in Split (1923) was carried out by Pasenti, who was comparing the relationship between the state of well-fed and plasmatic values of cholesterol. Higher values of cholesterol in blood was found by 3% of girls and 2.33% of boys, while the higher values of glucose were found by 1.69% of boys and 1.02% of girls. According to researches of relative weight, 12.3% of pupils suffer from malnutrition, while 8.7% of children are fat. Correlation between relative weight and cholesterol in blood was very low, as well as between relative weight and glucose. Ćurin spoke about insufficient fed of children in Split, according to the values of hemoglobin[72–75].

TABLE 6
RELATIVE BODY WEIGHTS (% OF STANDARD WEIGHT) OF A GIRL AT THE AGE OF 1 TO 14 IN REGIONS OF CROATIA TESTED IN 1954–56 AND 1973–76 (AFTER BUZINA[65])

Age (years)	Slavonija		Zagorje		Zagreb		Primorje		Dalmatia	
	1954–56 N=388	1973–76 N=380	1954–56 N=267	1973–76 N=443	1954–56 N=292	1973–76 N=379	1954–56 N=285	1973–76 N=213	1954–56 N=292	1973–76 N=379
1	98.0	98.5	94.1	97.8	97.0	102.4	98.0	106.5	94.9	101.9
2	100.1	98.9	93.3	99.5	97.4	103.5	102.1	106.3	99.2	98.6
3	99.7	99.9	95.3	100.6	98.3	99.4	100.9	107.2	98.6	100.3
4	98.3	99.5	96.7	99.8	98.1	106.5	99.5	109.4	96.5	100.6
5	98.5	99.7	99.0	99.5	97.4	108.6	99.1	108.1	97.8	98.9
6	99.3	100.7	97.9	102.0	98.0	103.3	98.7	105.5	97.6	102.6
7	99.5	100.3	102.5	100.4	97.4	105.4	100.8	108.3	98.1	100.8
8	102.6	100.9	103.5	101.7	95.7	104.0	103.7	106.0	99.4	97.8
9	100.0	99.8	100.7	100.0	103.2	110.3	101.0	108.4	95.5	99.7
10	97.9	100.0	99.8	100.3	99.2	107.6	98.2	104.7	95.2	98.4
11	97.8	99.7	100.7	97.6	98.9	104.1	98.6	101.7	95.2	94.7
12	94.2	102.4	105.1	98.3	97.1	103.7	98.6	94.4	94.0	98.6
13	98.2	99.5	96.7	98.1	104.7	108.3	101.7	101.4	91.8	97.6
14	94.0	99.8	96.6	99.7	94.8	105.6	94.2	102.6	97.0	100.0

TABLE 7
THE RESULTS OF CLINICAL RESEARCHES: PERCENTAGE OF CHILDREN WITH CLINICAL SYMPTOMS OF BAD NOURISHMENT IN CROATIA TESTED IN 1954–56 AND 1973–76 (AFTER BUZINA[65])

Symptoms	Slavonija		Zagorje		Zagreb		Primorje		Dalmatia	
	1954 N=767	1976 N=785	1954 N=550	1976 N=905	1954 N=504	1976 N=747	1954 N=556	1976 N=418	1954 N=572	1976 N=777
Skin										
Xerosis	0.4	0.6	6.2	2.1	3.8	1.2	0.8	0.4	0.4	0.4
Follicular hyperkeratosis	0.4	0.4	10.4	3.6	4.5	1.6	5.2	1.4	3.8	0.9
Lips										
Angular stomatitis	8.1	6.8	18.3	13.9	15.0	6.5	14.2	2.3	6.7	2.1
Gums										
Gums bleeding	9.5	5.4	18.8	9.8	8.2	5.1	18.6	2.1	5.0	0.8
Thyroid gland										
Goiter	66.4	1.7	70.1	1.4	57.1	1.8	23.8	0.9	27.3	1.1
Skeleton										
Caput quadratum	39.2	6.8	37.2	12.7	36.4	6.6	31.3	3.1	29.5	3.6
Thickening of epiphysis	43.1	5.6	44.2	2.4	39.9	3.7	82.7	3.8	62.3	4.8
Pectus carinatus	4.9	2.2	4.9	2.2	2.3	1.6	12.9	1.2	13.9	2.4
O legs	29.2	3.2	1.7	1.4	20.3	2.8	11.5	1.2	13.6	1.6
Tongue										
Atrophic papilla's	2.4	1.1	8.5	5.7	4.6	1.2	2.2	0.8	1.2	0.9

Kapetanović and his collaborators were researching 3,334 children at the age of 0 to 3, from three different parts of Croatia, Hrvatsko zagorje, Slavonski Brod and Knin (Table 8). Analysis showed that in two regions, 50% of children until 1 year started with artificial food, and insufficient food was found in children between 6 and 12 months, mostly in Hrvatsko zagorje and Knin. Malnutrition, discovered by anthropometric measurements, was found in 5% to 19.3% of children at the age of one year, and in 13% of children at the age of two and three years. Fatness was found in 8.8–19% of children at the age of 1 year, and 5–8% of children at the age of 2 and 3 years. By

biochemical measurements, lower values of proteins and albumin were found because of frequent infections and bad nourishment. Most children with lower values of proteins were in Hrvatsko zagorje, in the first year to 36.6%, and in the third year to 43.3%, while we can find lower values of albumin in the first year in 14–24.4% of children, and in the third year in 18.6–48% of children. From the specific nutritive deficiency, the most frequent are sideropenic anemia and rickets, which were found in the first year in 12.5–51%, and in the third year in 34–68.4% of children. These researches showed connection between mothers' education, caring out of prophylaxis of vitamin D and bone changes, and it was found out that the worst executing of prevention was among mothers with the low educational level[76,77].

Although widespread in nature and food, deficiency of calcium isn't rare, especially in women after menopause, when they often suffer from the loss of bone tissue that is osteoporosis. The research of influence of nourishment on the deficit of bone tissue was carried out by Matković on the population of Istria (town districts of Pazin, Buzet, Poreč) and Podravina (Virje, Novigrad, Gjurjevec, Molve, Novo virje, Ferdinandovec), when there were tested 1924 persons above the age of 30. The nourishment of these two populations differed in taking of proteins and it was found out that in Istria taking of proteins was more based on vegetable food, while taking of dairy products, as the source of proteins, was more characteristic for Podravina. By the analysis of nourishment, it was found out that people in Istria were taking 2–3 times less calcium, which didn't influence the loss of bone tissue because of vitamin D, which enables better absorption of calcium. The figures that resulted from work showed, according to the author, that we must influence prevention of osteoporosis with better nourishment in two periods of life, in the childhood and adolescence, in order to achieve bigger bone mass[78–82].

Researches of relative weight, as well as the influence of some widely used nutrients important for man's health, were carried out by Mimica and his collaborators. The sample contained 1,552 men and 1,667 women at the age of 37 to 58 in six town districts in Croatia (Zagreb-center and Črnomerec, Virovitica, Split-center, Omiš and Vis). The values of relative body weight of 96% to 110% had 42.6% of men and 32.1% of women. Less body weight, below 96% of relative body weight from the wished one, could be found in 10.7% of men and 5.1% of women, while the bigger weight from the wished one could be found (above 111% of relative body weight) in 23.9% of men and 25.2% of women. The fattiest people could be found in Split, Omiš, Vis and Zagreb–center, while the thinnest people were in Virovitica. By the analysis of the relationship of chronic diseases and the weight, it was discovered that fat people had more often cardiovascular diseases, diabetes and diseases of gall bladder, while thin people had very often chronic bronchitis. This study included researches of coffee influence and salty food on chronic diseases. It was discovered that 18.9% of men and 20.6% of women drink daily three or more cups of coffee, and we couldn't find the difference in weight between those who drink coffee and those who don't. Systolic and diastolic pressure showed bigger values in those who don't drink coffee, than in regular consumers of coffee. Besides, there were not found differences according to neurosis, bronchitis and gastrointestinal diseases. Testing of salting food discovered that out of 3,265 people, 62.8% »normally« salts the food, 17% salts more than necessary and 1,6% use too much salt. It's also discovered that country people salts food more than town people. The influence of salting food on systolic and diastolic pressure shows that the pressure is lower in those who use more salt than in those who normally salt the food. The only figure that shows that over salting causes hypertension is measurement in a group of 20 women who used more salt and had 8 cases of hypertension. There is connection between salting food and varicose veins, which are mostly diagnosed in people who use more salt in food[83–85].

The Period from 1980–1990

Keeping physical condition and work capability has always been for a man of vital importance, and it mostly depends on nourishment. That's why it's not difficult to conclude that the studies about the relationship between physical condition and nourishment have been always very interesting to the army. Physical activity has a strong influence on locomotor, digestive, respiratory and cardiovascular system, and there is no doubt that keeping good physical condition is used in the fight against overweight, as the cause of many diseases, like diabetes

TABLE 8
PERIOD OF BREAST-FEDDING, ACCORDING TO THE AGE OF CHILDREN FROM 1968–71 (AFTER KAPETANOVIĆ[76])

Period of breast feeding according to the age of children	Hrvatsko Zagorje		Slavonski Brod		Knin		Total	
	N	%	N	%	N	%	N	%
Number of breast feeding	57	4.37	83	7.79	38	4.82	178	5.64
1 month	275	21.1	220	20.66	68	8.63	563	17.84
2–3 months	377	28.93	353	33.14	138	17.51	868	27.51
4–6 months	237	18.19	196	18.4	168	21.32	601	19.04
7 and more	357	27.4	213	20	376	47.72	946	29.97
Sum of children	1303		1065		788		3156	

and coronary diseases. We can also conclude that we need optimal nourishment for a specific level of physical efforts, either in energy sense or in the sense of taking special nutrients. The source of energy for physical activity are first of all carbohydrates and fats, whose role is even bodily connected, while as for proteins, we must say that they lead to increased consumption of oxygen and consequently to decreased physical condition. According to Consolazi, physical condition in trained persons will be decreased for 50% in the period of 3 days, on a diet of high fats and low carbohydrates, and the best effect on condition and work ability is achieved in the period of 3 days on a diet of high carbohydrates and normal quantities of fats, as it is directly connected with the supplies of glycogen in the muscles.

The study of influence of nourishment on physical condition was carried out by Buzina and Subotičenec on the sample of 665 men at the age of 13 to 18. It was proved that under-weight persons with a relative weight under 90% of standard one had lower aerobic capacity, while the highest values of aerobic capacity were shown by the persons with a higher relative weight from 100% to 119%. Further increasing of relative weight above 120% of standard one was followed by decreasing of aerobic capacity. The persons under 90% of relative weight of standard one, had deficiencies of certain vitamins and minerals. According to the author, the development of soft tissues in the body can be considered as an indicator of well fed, and aerobic capacity depends mostly on development of muscle tissue, while the appearance of fat tissue will follow decrease of aerobic capacity. In regard of vitamin deficiencies on aerobic capacity, the most important parameters were iron (hemoglobin and hematocrit), the content o vitamins A and C in serum, as well as the content of riboflavin in erythrocytes. The proof for that is increasing of aerobic capacity after rehabilitation with vitamin deficiencies. It was also proved that receiving of exchangeable doses of pyridoxine and riboflavin, have no important influence on physical condition.

Subotičenec and his collaborators carried out a survey about the state of well fed of 112 older persons from pensioners' home in Zagreb. Analysis of the daily menus helped us to know more about energy sufficient nourishment, but the researches of the state of well-fed discovered great nutritive deficiencies, like lack of pyridoxine in 58% of persons, vitamin C from 21.4 –45.2% and riboflavin from 11.1–19.4%. The deficiency of iron was also diagnosed in tissues from 6.7–15.4%. For better investigating of functional meaning of present nutritive deficiencies, cell immunity was researched. It was proved by this research that around 20% of variability of cell immunity, in tested population of older persons, depends on supplies of vitamins and iron in nourishment. Scarce values of vitamin C, E, riboflavin and pyridoxine, as well as zinc and iron, are found in serum. The results suggest that nourishment is very important for immunological system of older persons[86,87].

The importance of daily nourishment of certain parts of population is to show certain lacks and deficiencies in nourishment, and by correcting them; we can improve our health and work abilities. In researches of nutritive and energetic needs of students, Colić discovered nutritive values of monthly menus of meals of students' social nourishment. The methods of these researches were analysis of daily menus according to nutritive tables and the results of chemical analysis, carried out by Public Health Institute in Zagreb. By analyzing meals, it was discovered that nutritive balanced quality and unevenness were very bad, and by the help of survey lists, nutritive and energy needs of this population were discovered. According to these researches, it was decided to make new standards for menus that would contain bigger portion of meat, vegetables and fruit, paste and rice and decreased portion of fat[88–93].

Breast-feeding nourishment and its influence on the later development of children at the age of 5 or 6 was investigated by Kapetanović. The state of well-fed was estimated on the sample of 648 children (338 boys and 310 girls) by percentage values of birth mass, body mass, length and height, at the age of 5–6 months and later at the age of 5–6 years. Birth masses were in 1/4 of children higher than in 90% of relative birth mass, and fatness was 2.5% in girls and 2.4% in boys. The number of fat boys until the age of 5 and 6 was doubled, and of girls quadrupled[94].

Kolaček was investigating the frequency of fatness in the group of persons from 14–19 years who were overfed in their childhood, as well as the roles of various factors in etiology of fatness. The methods of work demanded finding of population that was already measured in a unique way in their early childhood, so the figures by Kapetanović and collaborators from 1968 and 1969 were used for that purpose. There were 169 isolated children who were, according to the relative weight of that time, too fat, so they were examined again after 16 years. It was discovered that 137 persons out of 169 were overweight in the first 3 years of their life, and 32 were fat. After 16 years, it was found out that every second person has higher relative weight. Incidence of fat persons who were fat at the age of 3 was 43.8%, and in the group of former overweight children 20.5%, from which we can conclude that after 16 years more fat children come from the group of the overweight. It was also discovered that the most important predictor of the level of well-fed persons is relative weight of their mothers and fathers, what is seriously vivid in adolescent age. Such perceptions of these researches discovered hereditary characteristics of fatness, although social connection was also showed as relevant[76,95,96].

Socio-economic factors, important for breast-feeding nourishment, were investigated by Modrušan-Mozetič on 500 families, according to modified Graffar's social classification of families. The results of researches showed that social structure of families with mothers born in Rijeka is totally different from those whose mothers immigrated to Rijeka, which reflects on unpleasant situation of professional qualification and monthly income. The way of child's nourishment in the first 3 years of his

life differs according to the social class of his family, regardless of the same education of all mothers about the way of nourishment, from which we can conclude that mothers coming from families of lower social classes are more difficult in receiving advices about nourishment[97–99].

The Period from 1990 until Today

The 1990s were unfortunately war years in Croatia, the aggression of Yugoslav army left, among other things, consequences on nourishment of population, which can be felt even today. War events were accompanied with negative ecological changes, like devastations, negative socio-economical situation, great migrations, stress that causes the fall of immunity, radiological and chemical contaminations etc. It is necessary to have bigger quantities of qualitative food in the war because of many reasons like exposing to bigger physical efforts, and because of losing of energy, it is necessary to insure taking of caloric food. Man is exposed to various harmful biological agents, that's why organism needs protective nutrients in the form of various vitamins and minerals. The problem of bad quantitative and qualitative supply of food in such conditions is inevitable because of many reasons, like disarrangement of production and distribution of food. The way of nourishment often comes down to collective nourishment, and migrations of population cause quick growth of inhabitants in some regions, causing in that way deficiency of food. We also mustn't forget frequent devastations and contaminations of farmlands.

The result of such situation is often malnutrition, caused mostly by the lack of proteins, or as a partly or completely lack of vitamins in the form of hypo-or avitaminosis, of which the most often appearances are scurvy, beriberi, hemaralopia, pellagra etc. The consequences of acute and partly forms of hunger can turn to chronic forms, very dangerous for human health, children can suffer from deformations in growth and development, immunity is decreased, causing in that way appearance of infectious diseases, work ability is decreased, the wounded and sick recover very slowly. Because of great importance of nourishment during the war period in 1992 and 1993, there were held two important conferences 17th School of biological anthropology, named »Nourishment in war and postwar period« and 19th School of biological anthropology, named »Bread-Milk-Water« on which the lecturers were famous Croatian nutritionists and anthropologists: H. Maver, P. Rudan, S. Kolaček, T. Kapetanović, R. Živković, D. Matasović, A. Kaić-Rak, K. Antonić, J. Grgurić, and other respected scientists[100].

Kaić-Rak carried out figures about supply of energy and nutrients in Croatian population from 1991. According to these figures, average taking of energy was 2175 kcal, the portion of proteins was 71.7g, carbohydrates 281.4g, alcohol 7g, sodium 2.312mg, potassium 2.490mg, calcium 512mg, iron 9.1mg, vitamin A 343 R.E., vitamin B1 1mg, B2 1.3mg, B6 1.17mg and vitamin C 71mg. It is important to say that during that period Croatia entered DAFNE project (pan-European net of information about consumption of food got by surveys), in which it was important to ensure the control of daily taking of energy and nutrients, that is qualitative nourishment of population on a national level with indicators about healthy state of population and special reference to chronic diseases. According to the analysis of well fed of Croatian population from 1997, it was proved that there wasn't malnutrition in Croatia in the sense of energy deficiency. Although energy deficient food appeared only in 1.4% – 6.1% of inhabitants, the bigger problem was of qualitative nature. The main reasons for qualitative deficiency in nourishment were economical reasons, because of which people often buy cheaper and energy richer food instead of biologically more qualitative food. So we can mention the figures from 2003 about daily taking of cereals of 290g (of which 72% comes from bread), which was 30% of total daily taking of energy[101–103].

With the help of UNICEF, Zakanj and collaborators made a survey researches about the influence of war on breast-feeding in Croatia, which included 757 children under 2 years and 1,180 children between 2–5 years. The results showed that 94.6% of mothers have started breast-feeding, and the correlation between frequency of the beginning of breast-feeding and geographical position, or war events was not found. It was also discovered that breast-feeding was lasting longer in the parts of the country that didn't experience the war (Istria, Hrvatsko Primorje and Gorski Kotar) than in war-included regions (Slavonija). The results show that the war shortened the time of breast-feeding, and possible reasons for that are humanitarian donations with compensation of mother milk. Grgurić and collaborators were making researches on the sample of population from 3 regions in Croatia: in the free territory, from the first front line and on liberated territory. The respondents were households (1,563) who had children less than 5 years (1,937). Researches showed very low portion of breast feeding, while nourishment with cow milk was very high during the first six months (30%) and 1 year (60%) of child's life, which presents negative results in regard to high risk of sideropenic anemia in children fed with cow milk in their first year of life, as a result of lack of glycoprotein and lactoferrin, which can be found in mother's milk, and the lack of vitamin D was also noticed.

Researches, carried out by Berović on a sample of 500 mothers, showed that breast-feeding is more frequent in mothers who are older, more educated and non-smokers. It is also discovered that 30.7% of children are breast-fed after 3 months, only 11% after 6 months andμ 40% of children are fed with cow milk before their first year of life. Batinica investigated frequency of breast-feeding on 816 children (64% of totally born) in Međimurska county, 725 of children (51% from total number of born) in Sisačko-moslavačka county, and in Šibensko-kninska 716 children (61% from total number of born). The results showed that 61–85% of infants were breast fed until 2 months, 36–64% from 3–4 months and 14–53% from 6–7 months, from which we can conclude about positive trend of breast-feeding in Croatia. As for nourishment of

children, the subgroup for revision of National programme for children of State institute for family protection, maternity and youth, from domain of health and nourishment of children in 2002, defined the fundamental priorities for nourishment of children with three aims: promoting breast feeding, the programme of preschool children and the programme for improving nourishment of school children[104–107].

Unlike quantitive analysis, qualitive analysis of breast-feeding is carried out by Mandić and collaborators, by determining the quantity of copper and zinc in human milk on the samples taken in the clinical hospital in Osijek and in the refugee centre in Nabrde. The quantity of copper and zinc was tested depending on social status, age, number of breast feedings, day after breast feeding, smoking, information about child's taking of copper and zinc, which was varying, copper between 0.27–1.35mg/l, and zinc 0.62–15mg/l. Testing of daily taking of already mentioned chemical elements was carried out by Katalinić and collaborators. The choice of food and the way of preparing it corresponded to Dalmatian kitchen, while nutritive thickness of zinc, copper, manganese and iron was compared with recommendations of WHO/FAO, and it was concluded that the thickness of zinc was 30% less than recommended, while the thickness of copper responds to the recommendation[108–111].

The relationship between nourishment and etiology of various difficult and chronicle diseases is certainly the topic of many world researches of nourishment of this period. The researches of relationship between developing of stomach cancer and the way of nourishment, was carried out by Kaić-Rak. The sample in parallel investigations between 2 populations were the inhabitants of Vukovar and island Brač, and they included 80 persons at the age from 30–60 from each region. By comparing information about incidence of stomach cancer from 1982 and 1986 with incidence of stomach cancer in Vukovar, south regions and Croatia, there was great incidence of stomach cancer in Vukovar population in relation to Croatia, especially in relation to south regions. The researches showed that more qualitative nourishment is related to island population who has more satisfactory balance of saturated and unsaturated fats, because of use of vegetable oils, especially olive oil, while 90% of total taking of fat in Vukovar region are fats of animal origin. It was discovered that there was bigger consumption of complex carbohydrates, vegetables and fruit on Brač, that's why there is bigger taking of vitamins A and C as important elements in prevention of stomach cancer. There were also discovered statistically important differences in consumption of industrially prepared food, grilled food, sour ingredients, but also differences in frequent number of daily meals. Great differences are also in the structure of nourishment at the age of 25, when nourishment is poor with carotene, vitamin C and calcium, and consumption of alcohol is frequent, even at older age. Bad life habits and work conditions, low social status and unhealthy nourishment with less taking of carotene, vitamins C and B2 and calcium, as well as more taking of nitrates and nitrites from the environment, all that can initiate carcinogenesis[112,113].

Rudan and collaborators discovered differences in the rate of incidence of stomach cancer, colon cancer and pancreas, between two regions in Croatia, Koprivničko-križevačka county with continental way of nourishment, and islands in Dalmatia (Brač, Hvar, Korčula, Vis, Lastovo) with Mediterranean way of nourishment, for the period from 1986 to 1995. With great differences of nutritive habits, it was discovered that there was lower rate of incidence of stomach cancer and cancer of pancreas in both sexes in island population. Age standardized rates of cancer incidence of island population comparing with population in Koprivničko-križevačka county, was figured out on 100,000 inhabitants – 17.2 against 39.4 per mille, in men with stomach cancer – 9.1 against 16.5 per mille, and in women with stomach cancer – 34.5 against 31.4 per mille. Colon cancer shows more incidence in men of island population – 18.3 against 20.3 per mille, in women with colon cancer – 5.5 against 9.0 per mille, and in men with cancer of pancreas – 2.7 against 5 per mille. Standardized rates of incidence of stomach cancer and cancer of pancreas were much lower on these 5 Dalmatian islands. By comparing age standardized incidence for stomach cancer on our islands with corresponding age standardized rates in other European countries, similar values appeared in some parts of Italy, Spain, Germany, Czech Republic and Finland, while age standardized rates of incidence in Koprivničko-križevačka county are similar to those in Byelorussia, Estonia and Leetonia. Such results showed that Mediterranean way of nourishment decreases the risk of stomach cancer and cancer of pancreas, and according to researches of Car and collaborators, it is protective factor in the appearance of arteriosclerosis[114,115].

As many other diseases, cardiovascular diseases are very often connected with wrong nourishment, especially with too much taking of calories and saturated fat acids. In the purpose of early discovering of possible factors that might influence eventual cardiovascular diseases, additional researches were made by Kolaček and collaborators. After 18 years, 456 already tested persons were again invited to be examined, so anthropometric measurements were made, blood pressure was controlled, the puncture of veins was made and various questionnaires were carried out. By comparing these two researches, it could be concluded that the highest level of total cholesterol and LDL is most frequent in men who were thinnest in the first 3 years of life and fattest in adolescence. Taking in account results of anthropometric measurements, nourishment and social status of both life periods, the important factor was lower growth in adolescence, which was connected with malnutrition in the first 3 years of life. Systolic and diastolic pressures were also tested. The researches showed positive correlations between weight and blood pressure in children born with less body weight, and fattening in later years, which increased pressure, so it was proved that social situation influences higher values of systolic pressure[116–118].

The results of researches, carried out by Čubrilo-Turek and collaborators, showed that 10% of male popu-

lation has higher triglycerides above 6.01mmol/l, and female 3.13mmol/l, so it was proved that concentration of cholesterol in 10% of men was 7.6mmol/l, and in 10% of women 7.19%. Another important information is that 40% of energy in nourishment of Croatian population presents fat, and that higher cholesterol makes 50% risk of cardiovascular diseases according to Kaić-Rak. In favor of unbalanced taking of fats in east Croatia, we can mention researches about taking fats and fat acids, which was carried out by Primorac and collaborators, and according to which, daily taking of total fats was 33.4%, 9.9% saturated, 11.8% mono saturated, 9% poly saturated and 0.7% trans fats. Except of the influence of nourishment on already described diseases, the researches, carried out by Sepčić and collaborators in Gorski kotar, had the aim to show the connection of nourishment and multiple sclerosis, as Gorski kotar presents the zone of the greatest risk for this disease. 46 patients and 92 controls of autochthonous population were investigated, and it was proved that nutritive factors that might influence development of that serious disease in the zones of the highest risk, are unpasteurized milk, animal fat, smoked meat and potatoes[119–121].

At the beginning of 1990s, 40 years after iodine prophylaxis had been introduced to Croatia (10mg KI/kg of salt), there were carried out extensive researches on national level about frequency of goiter. Kusić was investigating 2,436 children of both sexes at the age of 7 to 15, as well as geographically and economically different regions in Croatia. The methods of discovering the goiter were palpation of the throat, according to the division of American health organization (PAHO) and world health organization (WHO), as well as ultrasound examination and measurement of iodine in urine. Analyzed regions were: Zagreb (740 pupils with 20% of goiter), Zagreb county (200 pupils from Rude district with 26% – 43% of goiter), Split (205 pupils with 6–10% of goiter), Lovreć (175 pupils with 14% of goiter), Rijeka (467 pupils with 12%–14% of goiter), Delnice (201 pupils with 18% – 35% of goiter), Osijek (245 pupils with 28% of goiter), Vuka (203 pupils with 23% – 37% of goiter). The results of researches showed that the decrease of goiter in Croatia isn't possible until obligatory content of iodine in salt increases from former level of 10mg KI/kg. In 2003, that is 6 years after regulation of iodizing of salt to 25 mg KI/kg, there were carried out new researches on national level, in order to confirm the effects of new regulations. Researches were carried out in 4 regions in Croatia: in the northwest part, Slavonia, north Adriatic and Dalmatia, on the sample of 927 pupils of both sexes at the age of 6–12. The values of sonographic volume of thyroid gland were in normal limits, according to the values WHO/ICCIDD, and the concentration of secreted iodine in urine of 14 μg/dl in average were within limits of normal values. Controls of domestic and imported salts that satisfied quantity of 25 mg KI/kg were made too. It was obvious from these researches that Croatia, after more than half of the century, reached normal values of iodine[122–125].

Researches on the sample of 1,048 pupils from Rijeka and 778 from Zagorje, Capak, show that in 40 years we achieved improvement of the state of well fed of school children at the age of 7 to 14. According to distribution of anthropometric parameters, population from Rijeka showed as taller and heavier for certain age, as well as heavier for certain height. We can find in both regions the values of anthropometric indexes 80%, which are interpreted as malnutrition, but we can also find the appearance of fatness, whose prevalence is higher in population from Rijeka. The study also showed that daily meal of examinees from Rijeka corresponds to the recommendations of RDA, by structure of carbohydrates, fats and proteins, but taking of vitamins A and C and calcium is lower than recommended, while total daily meal of examinees from Zagorje doesn't satisfy in energy sense, which resulted with the appearance of clinical symptoms of deficient nourishment, like follicular hyperkeratosis, angular stomatitis, atrophy of tongue papilla's etc, present in both populations. On the sample of 862 children from Prebukovje, Vrbno and Bednje, Lončar warned on being backward in growth and body, as well as in relative weight of children coming from poor villages, comparing with those from towns. The children from Prebukovje and Vrbno showed chronic nutritive deficiency, in favor of which we must mention, decreased development of soft tissues in relation to the size of skeleton. Nutritive deficient of country children were: proteins 5.3%, albumin 16%, hemoglobin 3.2%, hematocrite 5.2%, iron 12.3%, vitamin A 7.2%, vitamin C 21.6%, thiamine 1.5%, riboflavin 13.5% and pyridoxine 9.6% of examinees. For easy reference of the influence of nourishment on growth and well-fed of children, Antonić-Degač, in 1995, carried out researches in 2 ethnically homogeneous populations of school children in 2 geographically different regions, Bednja in Hrvatsko zagorje and Dugopolje in Dalmatinska zagora. Investigations were based on anthropometric measurements and interviews about 24 hours nourishment, and the results were compared with the same measurements from 1975. It was discovered that the boys in Bednja were taller in average for 3 cm, in Dugopolje for 4.7 cm, and the girls in Bednja for 3.5 cm, in Dugopolje for 6.4 cm. The most important difference in nourishment of children between 1975 and 1995 was increased taking of proteins of animal origin (Bednja 47%, Dugopolje 76%), which proves that there is positive correlation between taken quantities of proteins of animal origin and the growth of children[126–129].

The state of nourishment and well fed of school children in Split is investigated by Ćurin on the sample of 200 children in 1994, when it was discovered that there were 23.7% of malnutrition in boys and 27.1% in girls, and the values of hemoglobin under 120g/l was seen in 32.2% of boys and 19.6 % of girls. In 1999/2000, on the sample of 919 children registered in the first class of elementary school, there were made anthropological measurements and hematological researches (hemoglobin and hematocrite), and it was discovered that 64.8% of boys in all-day residence or 67.1% in shortened residence, as well

as 63.7% of girls in all-day residence and 68.2% in shortened residence were normally fed, while the signs of malnutrition were shown by 8.6% of boys in shortened and 4.9% in prolonged residence, and 6.9% of girls in all-day residence and 7.3% in shortened residence. Decreased values of hemoglobin were found in 13.3% of examinees with shortened residence and in 4.9% with prolonged residence, and the values above 120 g/l were shown by 55.6% of children with shortened residence and 63.4% with prolonged residence in the kindergarten. The investigation of children's nourishment in Bjelogorsko-bilogorska county on the sample of 1,399 children registered in the elementary school, discovers 14.9% of undernourished boys and 16.4% of girls, and 7.6% and 9.9% fat boys and girls. Jakovljević pointed out the frequent appearance of sideropenic anemia in children until 2 years, and the important factor for its development was bad socio-economical status with bad nourishment, composed mostly of flour and cow milk[130–134].

Researches of 575 school children and adolescents in Zagreb and Pazin were carried out by Colić-Barić and collaborators (Table 9). They discovered energy taking of 95.5 and 83.3% RDA in children and adolescents. Taking energy at breakfast was between 20–30% from the total taking, and there was also high taking of proteins of 253 and 139.6% RDA in children and adolescents. It was noticed that children had higher cholesterol, and adolescents daily taking of fibers, while consumption of fruit was 324 –204 g/per day. The differences in BMI index and nutritive parameters were not big. The researches in representative sample of 1190 children and adolescents showed the total taking of energy of 5% RDA for children and 23% RDA for adolescents, of which 26% of taking applies to breakfast, which has greatest share of milk and dairy products of 63.3%. The total taking of protein was 69%, 48.1% for children and adolescents, and like in former researches, cholesterol was higher in children – 24.3 mg and in adolescents – 19,6 mg, and taking of fibers was higher in adolescents. By comparing nourishment in rural and urban environments, it was noticed that in urban settlements there was trend inclining to healthier nourishment, while that trend was opposite in rural settlements. Energy daily taking was 27.5% RDA in urban and 23% RDA in rural regions, while divided on proteins, carbohydrates and fats, it was 15%, 32.6% and 52.4 % for both regions. Taking of cholesterol was higher in urban settlements, from 59.9% to 39.7%. Taking of micronutrients at breakfast (vitamins A, D, E, thiamine, riboflavin, niacin, vitamin B6, B12, calcium, phosphorus, magnesium, iron, zinc, iodine and selenium) was bigger in urban environment in %RDA and DRI, while taking of C-vitamin and folic acid was bigger in rural regions. Šatalić researches the state of nourishment of student population in Croatia in the school year 2002/03, in which he included 5 university centers (Zagreb, Split, Osijek, Rijeka and Zadar). By quantitative questionnaire (FFQ), 2,433 students were included (2.3% of total student population in Croatia). The results showed adequate taking of meals in both sexes, while men had in their nutrition more carbohydrates; women were taking food with bigger nutritive values. An average daily energy taking was relevant to recommendations, although taking of cholesterol was too high, and taking of nutritive fibers was too low. Adequate taking of micronutrients was discovered in 9.5 % of students, and it was also discovered that 50% of students didn't take enough quantities of iron, folacin and vitamin E. The quality of nourishment, according to the Mediterranean indicator of quality of nourishment (M-DQI), showed that the most number of students have bad nourishment (84.3%). The level of well-fed, regarding to BMI, showed that 80% of students are adequate fed and the biggest number of fat students were from Osijek and continental parts of Croatia, while the biggest number of under nourished students were from Zadar.

Investigation of differences in nourishment between fat adolescents and those with normal weight were carried out by Perl on the pupils of the 7th class of one school. The results showed that adolescents with normal weight prefer sweet, meat and cereals, which directed to psychological and social factors in fat adolescents. Antonić-Degač points to the great frequency of caries among school children in Croatia, about 52%. The main reason for it was the high percentage of consumption of refined sweets, sweet fruit syrup and carbonated drinks[135–141].

Celiac disease is chronical and it's caused by the deficiency of one enzyme, or by malfunction of metabolism after taking wheat, rye and barley flour, and it is demonstrated by insufficient absorption in intestines, because of gluten, which consists of glutenin and gliadin, causing gliadin shock in 10–20% of patients. Although the disease is genetically predetermined, immunological and envi-

TABLE 9
EVERYDAY TAKING OF ENERGY, PROTEINS, CHOLESTEROL AND FIBERS, INCLUDING RECOMMENDATIONS (% OF PERSONS (AFTER COLIĆ BARIĆ[136])

Parameters	Children	Adolescents
Taking in of energy (% RDA)		
<95	57.1	72.2
95–105	13.3	9.1
>105	29.6	18.7
Taking in of proteins (% RDA)		
<100	0.4	16.1
100–200	29.6	77.2
>200	70.0	6.7
Taking in of cholesterol(mg/day)		
<200	30.5	43.6
200–300	39.9	31.6
>300	29.6	24.9
Taking in of fibers (% of the age + 5 rule)		
<95	712	86.0
95–105	9.9	5.3
>105	18.9	8.8

ronmental factors are necessary for its appearance. The first signs of that chronic disease usually appear at the age of 5, and in Croatia, according to Matek, the number of sick persons is 1.9 per mille. In researches of Jadrešin, 71 patients were included in the way that 38 patients were on a strict nourishment without gluten, 23 were taking gluten occasionally, and 10 of them were constantly taking gluten, still there were not clinical, body or psychical symptoms of the disease: red blood test, smaller average mass, more frequent anemia and late sex. Kolaček points to the important decreasing of chromosome aberration in children who were on the diet without gluten.

The first evaluation of nutritive status of 284 gastroenterological patients (7% of pancreatitis, 10.9% of cirrhosis of the liver, 12.7% of gastritis, 10.9% of enteritis, 15.9% of chronical liver diseases, 17.2 of cancer and 25% without diagnosis) was carried out by Vranešić in Clinical Hospital in Zagreb. The nutritive status was evaluated by anthropometric measurements (body mass, height), dietetic estimate (qualitative questionnaire for estimate of food quality, way of living as well as self estimate of health and nutritive state) and biochemical analysis of parameters in blood (alkaline phosphatasis, albumin, total proteins, total cholesterol, triglycerides, potassium, sodium, chloride, calcium, phosphorus, magnesium, copper, iron, vitamin A, vitamin D, folic acid, vitamin B12, lymphocytes and thrombocytes). According to the estimate of BMI index 7.3% of patients were undernourished, 5.1% were exposed to that risk, while 37.2% were overweight and 20.8 were fat. Most of the patients were discovered to have inadequate taking of fruits, vegetables and dairy products. Frequency of malnutrition estimated by the method of subjective general appraisal (SGA) was 61.1% out of which 46.1% were only little undernourished and 15% were very undernourished persons. Examined persons were divided into groups (A – adequately well-fed, B – only little undernourished and C – very undernourished) by SGA method and statistically they differed widely according to BMI, the level of albumin, total proteins, calcium, iron, triglycerides, cholesterol, vitamin A and lymphocytes, so resulting with the lower values of these parameters in groups B and C. Vivid undernourishments (by methods BMI and SGA) were found out mostly among the patients who suffered from enteritis and there were also discovered radical departures of biochemical parameters from normal values.

Patients suffering from cirrhosis of the liver had very high values of body mass index (BMI) as a result of a specific pathophysiology (liquid retention), that's why the author points out that body mass and body mass index are unreliable parameters in evaluation of nutritive status in those patients, what directs to the methods of SGA and biochemical parameters. These patients had also lower serum level of vitamin A. The author also shows that an early nutritive intervention for the patients exposed to high risk can't evaluate efficacity unless evaluation of nutritive status was made while receiving them into hospital[142–146].

Apart from presenting the first and the only food for man in the first months of life, milk is admitted in the world as the fundamental nutritive product that contains not only energy value, but also vitamins and minerals. As most of people stands milk without problems, its consumption is pretty large in the world, so in some countries people consume 600 l of milk per person, while in our country, the consumption of milk is pretty low (around 100 l / per the member of the household). Important information is about everyday consumption of milk in only 66% of school children and 45% of adolescents. Colić Barić and collaborators test the influence of dairy products on certain population groups, as well as presence of milk and dairy products in the nourishment of socially handicapped older persons (Table 10). Milk and dairy producers presented the main products for breakfast of school children. We can also say that there was bigger taking of milk and dairy products in urban settlements, and as for sex, there was bigger taking in girls. Panjkota Krbavčić researches milk and dairy products in hospital children and the presence of milk and dairy products in hospital nourishment of pregnant women suffering from diabetes. The most consumed dairy products in pregnant women were milk and yogurt, which satisfied the needs of taking minerals (calcium and phosphorus), vitamins and riboflavin[147–153].

Recently, we have found in human nourishment many elements with harmful and toxic effects, which are the consequence of anthropogenic processes, mostly of industrialization of the last century. Many of these elements are pretty widespread, so we find them in the ground, water and air. In regard to the natural cycle of elements, such elements often finish in human milk, as well as in other animal milk and fats, but also in meat, vegetables and fruit. The research of daily taking of pretty widespread and toxic heavy metals, lead and cadmium, was carried out on Croatian population by Sapunar-Postružnik from 1988 to 1993. The results of researches showed daily taking of these elements: 701μg of lead and 4μg of cadmium per person, what would be according to tolerant table for 1 week (PTWI) 19.9% for lead and 24.4% for cadmium. Daily taking of arsenic per

TABLE 10
ANTHROPOMETRIC CHARACTERISTICS OF EXAMINEES (AFTER COLIĆ BARIĆ[149])

Parameters	Urban environment	Rural environment
Body mass		
Boys	66.9±11.54	72.4±9.65
Girls	58.2±7.53	60.7±7.77
Body height		
Boys	177.4±5.8	178.8±5.07
Girls	167.2±6.15	162.3±7.22
Index of body mass BMI (kg/m^2)		
Boys	21.0±3.11	22.6±2.84
Girls	20.8±2.27	22.0±2.20

person was 7.8% from allowed quantity, according to PTWI table. Blanuša and collaborators, by measuring biological materials (fish, mussels, vegetables, bred animals), estimated taking of lead and cadmium on 6–40% from allowed taking, by PTWI table, and the most part of Croatian population consuming mercury was in Dalmatia. Opposite of researches of harmful elements, Klapec and collaborators, as well as Matek and collaborators, investigated the taking of selenium. Selenium, as essential element for man, has become very important recently, because of its strong antioxidant characteristics, what classifies it in preventive potential for many diseases (like Keshanov disease), harmful influences of heavy metal, and it has important role in etiology of cancer. Klapec researches supplying with selenium in regions with endemic nephropathy. With the analysis of food from endemic and controlled region and with determining its consumption, it was found out that endemic population takes more selenium than controlled, and some examinees even more than recommended daily dose. Considering the results, Klapec doesn't exclude the influence of selenium in etiology of nephropathy. Another important thing is taking of fibers that represent short chains of fat acids and gasses, and their positive effect is the reduction of glucose in serum, cholesterol and preventive importance in cardiovascular diseases. Perl researches taking of fibers on the sample of 54 persons from east Slavonia. Researches based on enzymatic-gravimetric methods showed sufficient daily taking of 30g. It is also pointed to 21% of higher taking of fibers during the summer period, what is caused by enlarged taking of fruit and vegetables, which after cereals, give the biggest contribution to the taking of fibers[154–161].

In Collegium Antropologicum

Collegium Antropologicum was edited for the first time in 1977 that was the journal with different fields of anthropology and similar scientific disciplines, certainly including nutrition. Concerning many important works about population researches in Croatia, it represents important part in totality of journals that edited works on mentioned theme. Collegium Antropologicum and nutrition are certainly connected by the fact that Professor Maver, a co-founder of this journal, was one of the pioneers of anthropological nutritive science in Croatia.

Concerning nutritionist themes, Collegium Antropologicum deals with nutritive status, nourishment of children, regional populations, patients and the influence of nourishment on certain diseases. We must emphasize the works that stressed necessity for multidiscipline approach to nutritive science, and which were led by Lazarević's work. The most important authors who edited their works on nutritive theme in Collegium Antropologicum were Z. Kusić, A. Kaić-Rak, J. Grgurić, N. Smolej-Narančić, A. Sujoldžić, L. Škreblin, S. Turek, M. Strand, E. Mesaroš-Kanjski, Ž. Prebeg, M. Čubrilo-Turek[16,162].

With the idea of multidiscipline approach, Lazarević researches the nourishment of two islands belonging to Zadar archipelago, Silba and Olib. In his work, Lazarević represents socio-cultural teaching of nourishment on these two islands, giving most attention to tradition and culture of the inhabitants´ nourishment. In order to determine biological status of these islands, Smolej and collaborators carried out researches a year earlier. There were measured 49 morphological and physiological variables, which discovered great difference in certain parameters on this specific island population[16,163].

Evaluation of nourishment state and nutritive status of adolescents were carried out with multidiscipline approach by Škreblin and Sujoldžić in researches on island Hvar, on a sample of 299 inhabitants at the age of 15 and 19 (40% of total number of that part of population). Multidiscipline approach consisted of biological, collecting anthropometric figures, weight, height with the aim of counting index of body mass ITM, social, standardized nutritive questionnaire and psychological questionnaire about demographic, psychological and social characteristics of examinees. It was shown that the greatest number of examinees belong to the category of normal or wished index of body mass, that nourishment mostly corresponds to recommendations of the world healthy organization, and that nourishment habits were different according to demographic differences of examinees, sex, place of birth, origin and socio-economical status of the family[18].

In order to define nutritive status of Dalmatian population, Smolej Narančić and collaborators tested 4,507 people at the age of 18–74. In these researches, there were used the results achieved by numerous anthropometric investigations in Dalmatia (Pag, Olib, Silba, Brač, Hvar, Korčula, Pelješac), in the period from 1978 to 1987. The results got by anthropometric measurements were compared with the results of US NHANES II documents, and there were noticed numerous differences, for which it was not clear whether they were the result of different arrangement of body fats or body construction. According to BMI, Dalmatians have more body fats, what may be the result of centralization of body fats or stronger body musculature. Researches, that had already been carried out by Prebeg and collaborators, and which had been comparing school population within Croatia, as well as with USA, showed that BMI of school children in Zagreb was higher than in other parts of Croatia, as well as it was higher than BMI of school children in USA[164–173].

The studies of evaluation of nutritive status of 181 pregnant women, investigated by Zekan and collaborators, showed that the average increase of body weight at the end of pregnancy was 4.4kg, of which 5.7kg was body fat. According to parameters of body mass index (BMI) and the thickness of skin wrinkle of triceps, the weight of children was estimated. The researches, carried out by Puljević and collaborators, show connection between body mass and appearance of rheumatic symptoms, which discovers that increased body weight is an additional factor in the appearance of mentioned symptoms. Puljević and collaborators also estimate the relationship between higher body mass and complex illnesses on the

sample from 1,583 workers of a railway company. The investigations showed less frequency of such illnesses in people with ideal body mass, while another study showed higher frequency of osteoporosis in fat women. This study proved that nourishment is absolutely one of the essential ecological factors that influence the development of these illnesses[174–176].

In conducted analysis of lipids, lipoproteins and markers of fibrinolitic activity, carried out by Čubrilo-Turek, it is showed that higher concentration of fibrinogen represents the most risky factor in myocardial infarction, and Vincelj and collaborators point out a higher total cholesterol in 75% of patients with acute myocardial infarction, as well as pretty higher LDL cholesterol. Sučić and collaborators investigate nourishment with pilchards in patients with hyperlipoproteinemia, and show that nourishment with fish, statistically, greatly decreased the level of total cholesterol for 10.7%, LDL cholesterol for 11.7%, VLDL cholesterol for 14.8% and triglycerides for 12%. These results help the author to conclude that nourishment with pilchards can help to decrease the development of arteriosclerosis[177,178].

After liberation of occupied territories in the period between 1995–1997, very important researches were carried out by Turek and collaborators, by the help of Ministry of health and Croatian health insurance. These researches were conducted with the aim of development and planning strategy of prevention and necessary help to the total population in Croatia. By evaluation of BMI values, 48.1% of men and 34.7% of women showed overweight, measurements of blood pressure showed that around 50% of men population has higher pressure, systolic above 83mmHg and diastolic above 13mmHg, 27.7% of population suffered from hypertension, that is systolic pressure above 140mmHg and diastolic above 90mmHg. Comparing men and women, percentage of hypertension was 31.9/23.6. By measuring triglycerides, it was discovered that men have higher values than women, consistently to the age, as well as values of HDL and LDL cholesterol according to nutritive questionnaires, it was discovered in 94.4% cases that cooked food is much healthier, as well as taking fish at least once a week[179].

Grgurić and collaborators research on a sample of population from 3 regions in Croatia, free territory, the first line of front and liberated parts. The questioned persons were from households (1,563) who had children under 5 (1,937). Researches discovered very low rate of breast feeding, and very high nourishment with cow milk during the first 6 months (30%) and 1 year (60%) of child's life, which represents negative results in regard to high risk of sideropenic anemia in children fed with cow milk in the first year of life. Apart from these results, it was noticed that children are badly supplied with iron, because of lack of glycoprotein and lactoferin, which can be found in mother's milk, and another discovered thing was lack of vitamin D[180].

The study by Strand and collaborators about geographical extension of cancer in Croatia with emphasis on nourishment, shows equal extension of colon cancer on the whole territory except Zadar and Lika, cancer of gullet is spread in Hrvatsko Zagorje, Varaždin, Osijek, Slavonski Brod and Istria, while liver cancer is mostly frequent in east Slavonia and south Damatia[181].

Identifying of goiter was carried out by Mesoraoš-Kanjski and collaborators, by researching on north Adriatic island Krk on the sample of 1975 school children between 7 and 19. Prevention of goiter in children was 29.8%, and average levels of vitamins A and E in plasma of children with enlarged thyroid gland were lower referential values. In 1996, Kusić, in his researches, connected with taking of iodine in organism, define that in continental parts of Croatia, 69–86% of children secret more than 5μg iodine per dl of urine, 17.34% secrets more than 10μg/dl, and in 5–13.2% of children in Zagreb, thyroid gland was above upper limit for their age. Kusić and Jukić, in 2005, also in Collegium Antropologicum, edited comprehensive and well laid out work about the history of goiter in Croatia[182–184].

Conclusion

In this well laid up paper, the intention was to include as many researches of nourishment as possible, which were carried out in Croatia, and which were characterized by varieties of its themes and methodology.

From the very beginning of nutritional research up today, certain number of institutions and scientists were included in many projects of nutritional researches and researching themes, and they gave wide and diverse opus of scientific works. Looking numerically, 44 qualifying works, of which 26 master's degrees and 18 doctoral dissertations (Table 11) were made on nutritional research of Croatian population. In the very development of nutritional researches, important contribution was given by Collegium Antropologicum – C.C. journal with publications of great number of works from that rich and wide scientific field. As this work pointed to the necessity of such researches on Croatian population, we can conclude that nutritional anthropology will go on with its development, including increasing number of scientists-researchers as well as amateurs.

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TABLE 11
QUALIFYING THESIS ABOUT RESEARCHES OF NUTRITION OF POPULATION IN REPUBLIC OF CROATIA

Type of qualifying thesis	Name of the author	Name of thesis	Year	Institution	Thesis advisor
Master's degree	Ivo Jelčić	Change of the attitude of school children to milk prepared from milk powder (use of technique of a small group): sociogrammes in experimental classes	1968	Faculty of Medicine, Zagreb	
Master's degree	Tomislav Horvat	Comparatively testing of knowledge and attitudes about nutrition of the 2nd and 8th graders of elementary school in town and village	1977	Faculty of Medicine, Zagreb	E. Ferber
Master's degree	Dagmar Loffler-Badžek	The choice of fundamental anthropometrics criteria for evaluation and observation of children's feeding up condition	1978	Faculty of Medicine, Zagreb	R. Buzina
Master's degree	Mirjana Smoljanović	The structure of nutrition in educational institutions is the essential factor in minors´ resocialization	1979	Faculty of Medicine, Zagreb	E. Ferber
Master's degree	Zlata Modrušan-Mozetić	The influence of socio-economic factors on the nutrition in infancy	1980	Faculty of Medicine, Zagreb	M. Juretić
Master's degree	Jadranka Marušić	Pupil's nutrition in Split	1980	Faculty of Medicine, Zagreb	R. Buzina
Master's degree	Mirjana Rumboldt	The relationship between arterial pressure and pupils´& youth's feeding up condition	1981	Faculty of Medicine, Zagreb	R. Buzina
Master's degree	Serafina Pasenti	The relationship between nutritive condition and level of cholesterol and glucose in pupils´ and youth's blood	1981	Faculty of Medicine, Zagreb	R. Buzina
Master's degree	Gorjana Gjurić	The activity of rennin and concentration of aldosteron in the plasma of infants with different taking of sodium and potassium into food	1981	Faculty of Medicine, Zagreb	D. Mardešić
Master's degree	Sanja Kolaček	Evaluation of factors that influence maintaining or change of fatness in overweight infants and little children in later development	1985	Faculty of Medicine, Zagreb	T. Kapetanović
Master's degree	Vesna Bosanac	The causes of early ablactation in contemporary conditions of socio-economical development of a family in one district	1985	Faculty of Medicine, Zagreb	I. Švel
Master's degree	Irena Colić	Nutritive values of the meals of social nourishment of students and confirming normative	1987	Faculty of food and biotechnology Zagreb	N. Jurković
Master's degree	Josip Lončar	Influence of the primary health protection in nutritive improvement of school children	1989	Faculty of Medicine, Zagreb	R. Buzina
Master's degree	Nevenka Jelić	The level of serum albumin and cholesterol in infants on a short lasting nourishment	1992	Faculty of Medicine, Zagreb	T. Kapetanović
Master's degree	Vesna Milas	The meaning of the way of nourishment on the beginning of infant diarrhea syndrome	1992	Faculty of Medicine, Zagreb	A. Votava
Master's degree	Krunoslav Capak	Nourishment and the state of well fed of the pupils In elementary schools in some parts of Croatia	1994	Faculty of Medicine, Zagreb	M. Sučić
Master's degree	Dobrivoje Godić	Distribution of pesticides and polychlorinated biphenyl in serum and mother's milk and in their infant's serum in the region of Prekomurje	1994	Faculty of Medicine, Zagreb	B. Štampar-Plasaj
Master's degree	Vesna Benjak	Clinical testing of preparation Bebimil 0 for infant's nourishment	1994	Faculty of Medicine, Zagreb	D. Mardešić
Master's degree	Ahmad Omar Awad Mustafa	The state of well fed of school children in refugee centers in Zagreb	1997	Faculty of Medicine, Zagreb	S. Kolaček
Master's degree	Tomislav Klapec	Evaluation of daily taking of selenium in food	1997	Faculty of food and biotechnology Zagreb	M. L. Mandić
Master's degree	Branka Rožić-Anđel	The influence of the factors of outer environment on children's well fed and the possibility of preventive activity of family doctor	1999	Faculty of Medicine, Zagreb	J. Grgurić
Master's degree	Katica Antonić-Degač	The influence of nourishment on growth and well fed in 2 ethnically homogeneous populations of school children	1999	Faculty of Medicine, Zagreb	A. Kaić-Rak

TABLE 11
CONTINUED

Type of qualifying thesis	Name of the author	Name of thesis	Year	Institution	Thesis advisor
Master's degree	Zora Zakanj	The influence of prenatal factors on growth and development of children during their first year of life	2001	Faculty of science, Zagreb	J. Grgurić
Master's degree	Lana Škreblin	Anthropological research of nutritive habits and biometric evaluation of nutritive status of adolescents	2003	Faculty of science, Zagreb	A. Sujoldžić
Master's degree	Olga Jadrešin	The influence of disregard of nourishment without gluten on health state of children with celiac disease	2003	Faculty of Medicine, Zagreb	S. Kolaček
Master's degree	Zvonimir Šatalić	Nutritive habits and the quality of nourishment of students´ population in Croatia	2004	Faculty of food and biotechnology Zagreb	I. Colić-Barić
Doctoral dissertation	Ratko Buzina	Coaguability of blood and its changes influenced by nourishment and some other factors	1964	Faculty of Medicine, Zagreb	E. Hauptman, B. Kesić
Doctoral dissertation	Ana Brodarec	Nutritive research of 2 populations connected with etiology of heart diseases in Croatia	1965	Faculty of Medicine, Zagreb	B. Kesić, R. Ivančić
Doctoral dissertation	Dinko Kello	The influence of age, sex and nourishment	1975	Faculty of Medicine, Zagreb	K. Kostial
Doctoral dissertation	Velimir Matković	The influence of age, sex and nourishment on the loss of bone tissue	1976	Faculty of Medicine, Zagreb	K. Kostial
Doctoral dissertation	Milivoj Kačić	The influence of age and nourishment on the level of lipids in the blood of older infant and little child	1976	Faculty of Medicine, Zagreb	B. Štampar-Plasaj
Doctoral dissertation	Tomislava Kapetanović	Clinical epidemic characteristics and the importance of nutritive disorders in the children in the first 3 years of life in 3 different regions in Croatia	1979	Faculty of Medicine, Zagreb	I. Švel
Doctoral dissertation	Ljiljana Audy-Kolarić	Comparative research of the influence of modality of chemical compensation on the balance of nitrogen in parental nourishment	1980	Faculty of Medicine, Zagreb	B. Štampar-Plasaj
Doctoral dissertation	Kornelija Subotičanec-Buzina	The influence of nourishment on physical condition of teenagers	1984	Faculty of Medicine, Zagreb	R. Buzina
Doctoral dissertation	Nada Panjatović	The influence of body weight and nourishment on tolerance of glucose in the examinees with damaged tolerance of glucose after 10 years of testing	1988	Faculty of Medicine, Zagreb	Z. Škrabalo
Doctoral dissertation	Irena Colić-Barić	Nutritive contribution of soya proteins to nutritive status	1996	Faculty of food and biotechnology Zagreb	N. Jurković
Doctoral dissertation	Antoinette Kaić-Rak	The influence of nourishment and some life habits in the beginning of intestinal of metaplasia precancerogenesis of stomach cancer	1996	Faculty of Medicine, Zagreb	I. Rotkvić
Doctoral dissertation	Ljiljana Primorac	Characteristics of part of population in east Slavonia concerning taking of fats and fat acids	1998	Faculty of food and technology, Osijek	M. L. Mandić
Doctoral dissertation	Elika Mesaroš Kanjski	Endemic goiter in school children on island Krk	1998	Faculty of Medicine, Rijeka	Z. Kusić
Doctoral dissertation	Ines Panjkota Krbavčić	Nutritive value and protein digestibility of milk food for infants	2000	Faculty of food science and biotechnology Zagreb	I. Colić-Barić
Doctoral dissertation	Tomislav Klapec	The role of taking of selenium with food in etiology of endemic nephropathy	2001	Faculty of food science and technology, Osijek	M. L. Mandić
Doctoral dissertation	Antonija Perl	Daily taking of nutritive fibers determined by 3 dieting methods	2002	Faculty of food and biotechnology Zagreb	LJ. Primorac
Doctoral dissertation	Kornelije Brkić	Biometric analysis of nutritive indicator of the state in Croatian army	2003	Faculty of Medicine, Zagreb	P. Rudan
Doctoral dissertation	Darija Vranešić	Assessment of nutrition status of the patients at department of gastroenterology	2005	Faculty of food and biotechnology Zagreb	Ž. Krznarić

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NUTRICIONISTIČKE STUDIJE U HRVATSKOJ – STOLJEĆE ISTRAŽIVANJA

S A Ž E T A K

Ovaj rad posvećen je pionirima nutricionističkih istraživanja u Hrvatskoj; profesoru Edvinu Ferberu, profesoru Hubertu Maveru i profesoru Ratku Buzini, kojima možemo zahvaliti za izvanredne doprinose u razvoju znanosti o prehrani, kao i za niz znanstvenih publikacija od 50-tih do 80 -tih godina 20. stoljeća, ostavljajući nam izuzetne informacije o prehrambenom stanju u Hrvatskoj populaciji. Rad donosi pregled rezultata dosadašnjih nutricionističkih istraživanja u Hrvatskoj. Posebna pažnja posvećena je povijesnom pregledu te radovima objavljenim u časopisu Collegium Antropologicum. Od početka nutricionističkih istraživanja do danas priličan broj institucija i znanstvenika bio je uključen u mnoge projekte, dajući širok i raznolik opus znanstvenih radova, što dovoljno dobro oslikava multidisciplinarni pristup ovoj temi. U radu se također osvrćem na rezultate istraživanja 44 kvalifikacijska rada od kojih je bilo 26 magistarskih radova i 18 doktorskih disertacija.