

# SOME EFFECTS OF FAMINE ON THE POPULATION OF GREECE

V. G. VALAORAS, M.D., D. P.H.<sup>1</sup>

## A. VITAL STATISTICS DURING THE FAMINE

THE second World War and its evil aftermaths of occupation, famine, and civil disturbances have had a profound effect on the entire fabric of the population of Greece. Damages and losses in human life were great, not only during the short but costly war in Albania, in the Northern Frontier and the Island of Crete, but even more so during the occupation when another kind of unofficial war was always present. Most important of all was the country-wide famine of 1941-1942, which killed and disabled large masses of the population. The resistance movement and the civil war were only second in importance to the famine in inflicting heavy losses on the already depleted classes of young and middle-aged male population of Greece.

Unfortunately, the exact measurement of these losses is not as yet available for the country as a whole, and it is doubtful if ever it will be ascertained with any degree of accuracy. Civil registration of vital statistics was the first administrative procedure to be paralyzed immediately after the occupation. Furthermore, communications with the provinces became difficult and sometimes impossible during the occupation. All attempts to reorganize them were unsuccessful.

The following numbers, which are given as an example illustrating that period, refer to the twin cities of Athens and Piraeus (population 956,813 in the 1940 Census) where registration was kept at a satisfactory level. Marriages, births, and deaths are given for these two cities in actual numbers since their presentation in "rate form" would be subject to criticism because of the extensive

<sup>1</sup> Associate Professor of Hygiene, Athens University.

migration of the population which occurred to and from Athens during that time. The data are given from 1940 which, with the exception of the last two months, may be taken as a prewar normal year for Greece. Unfortunately again, the data are not absolutely uniform because only the first three years refer to the

Table 1. Marriages, births, deaths, and natural increase of the population in Athens and Piraeus, 1940-1945.<sup>1</sup>

YEAR AND QUARTER	MARRIAGES	LIVE BIRTHS	DEATHS	NATURAL INCREASE
<i>1940</i>				
Jan.-Mar.	2,499	5,237	3,656	1,581
Apr.-June	1,492	4,093	3,224	869
July-Sept.	1,498	4,556	3,131	1,425
Oct.-Dec.	1,489	4,650	3,337	1,313
<i>1941</i>				
Jan.-Mar.	1,612	4,704	4,019	685
Apr.-June	1,378	3,867	3,897	- 30
July-Sept.	2,102	2,800	4,793	-1,993
Oct.-Dec.	1,686	2,353	13,487	-11,134
<i>1942</i>				
Jan.-Mar.	1,434	3,484	17,529	-14,045
Apr.-June	1,635	3,025	9,395	-6,370
July-Sept.	1,717	1,819	6,971	-5,152
Oct.-Dec.	1,766	1,935	6,916	-4,981
<i>1943<sup>1</sup></i>				
Jan.-Mar.	1,517	2,459	3,112	- 653
Apr.-June	1,339	2,707	2,218	489
July-Sept.	1,722	2,968	2,251	717
Oct.-Dec.	2,122	4,180	2,398	1,782
<i>1944<sup>1</sup></i>				
Jan.-Mar.		4,671	3,278	1,393
Apr.-June		5,272	3,533	1,739
July-Sept.		5,536	3,807	1,729
Oct.-Dec.		4,136	5,389	-1,253
<i>1945<sup>1</sup></i>				
Jan.-Mar.		6,706	4,278	2,428
Apr.-May		3,580	2,011	1,569

<sup>1</sup> From January, 1943 onwards the numbers refer to the narrower area of the two cities which includes 72 per cent of the population of the former larger areas of Athens and Piraeus. In the graphs all the numbers beginning with January 1943 have been increased by 39 per cent to make them comparable with the previous data.

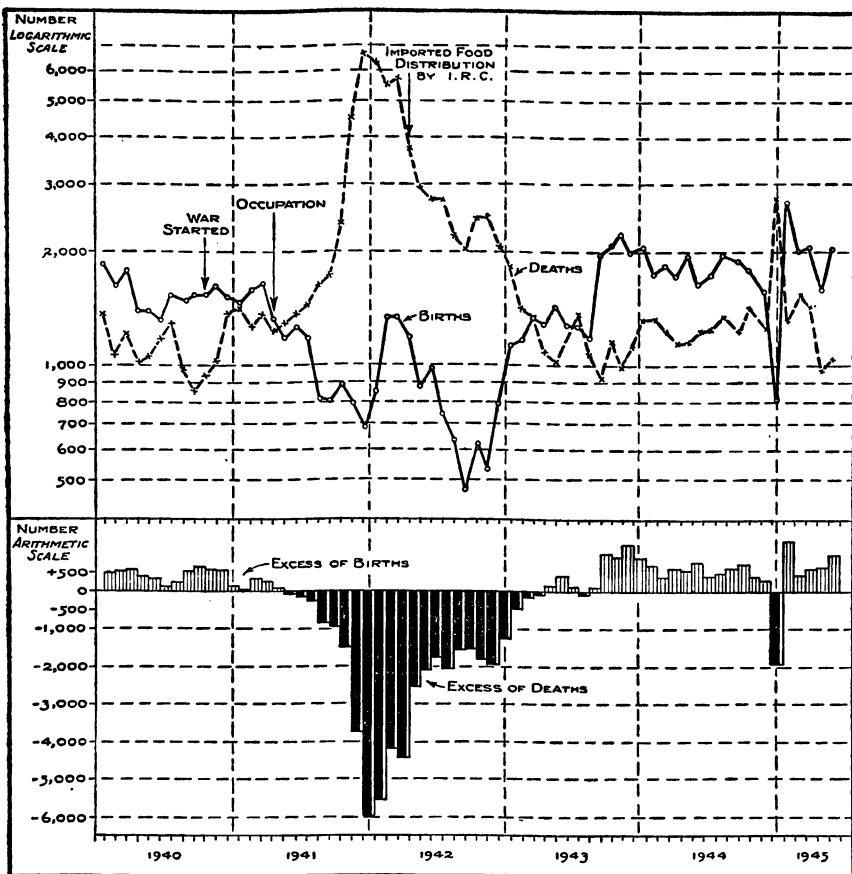


Fig. 1. Numbers of births and deaths, and excess or deficiency of births as compared with deaths in Athens-Piraeus, by month, 1940-1945.

above population. From January 1943, the data apply to a smaller area representing 72 per cent of the original population. Furthermore, the period from March 1944 to May 1945 is covered by the information collected by the Ministry of Hygiene which may differ from that of the Statistical Service. However, even with this crude presentation of the facts, some interesting points have emerged to show the dramatic repercussions of these historic events on the population of Greece.

In Table 1, quarterly totals are given for marriages, live births, deaths, and the natural increase of the population (births minus

deaths) during this five-year period which included the country-wide famine of 1941 and 1942. Monthly data are shown in Figure 1 for births, deaths, and natural increase. In this chart and in Figures 2 and 3, the numbers in the corresponding tables for 1943 and later years have been increased to adjust for the 28 per cent of the population for which data were not available.

Births which had exceeded deaths by an average of 400 per month began to decrease in numbers in the beginning of 1941, while the number of deaths increased rapidly. The two lines crossed each other in April 1941, the month in which the Ger-

Table 2. Numbers of deaths by age and sex in Athens and Piraeus, 1940-1944.

YEAR AND QUARTER	MALES						FEMALES					
	0-4 Years	5-19 Years	20-39 Years	40-59 Years	60+ Years	All Ages <sup>1</sup>	0-4 Years	5-19 Years	20-39 Years	40-59 Years	60+ Years	All Ages <sup>1</sup>
<b>1940</b>												
Jan.-Mar.	238	112	362	465	786	1,979	231	119	254	242	835	1,677
Apr.-June	325	125	366	367	588	1,781	308	113	249	222	541	1,443
July-Sept.	409	116	348	309	474	1,665	382	117	249	209	498	1,466
Oct.-Dec.	293	101	369	418	703	1,895	252	103	213	220	639	1,442
<b>1941</b>												
Jan.-Mar.	236	138	645	463	831	2,327	222	107	269	260	825	1,692
Apr.-June	352	147	604	443	666	2,250	297	105	294	247	692	1,647
July-Sept.	376	179	739	639	845	2,794	394	154	346	285	803	1,999
Oct.-Dec.	680	237	1,179	2,221	4,664	9,108	533	148	517	660	2,485	4,379
<b>1942</b>												
Jan.-Mar.	829	373	1,593	3,175	4,899	11,168	725	259	572	1,157	3,555	6,361
Apr.-June	454	343	1,028	1,545	1,803	5,225	461	301	525	836	2,006	4,170
July-Sept.	486	280	665	938	1,289	3,700	460	238	406	563	1,566	3,271
Oct.-Dec.	348	232	729	878	1,361	3,590	284	249	390	604	1,759	3,326
<b>1943<sup>2</sup></b>												
Jan.-Mar.	153	117	365	377	574	1,616	119	124	261	225	761	1,496
Apr.-June	104	148	369	293	346	1,270	89	101	219	159	379	948
July-Sept.	163	118	325	267	360	1,233	152	98	209	200	359	1,018
Oct.-Dec.	151	126	400	302	369	1,348	157	98	208	183	404	1,050
<b>1944<sup>2</sup></b>												
Jan.-Feb.	131	81	319	266	349	1,146	91	63	161	143	453	911

<sup>1</sup> Includes unknown ages.

<sup>2</sup> Figures are for restricted area of cities including only 72 per cent of the total population. (See footnote to Table 1.)

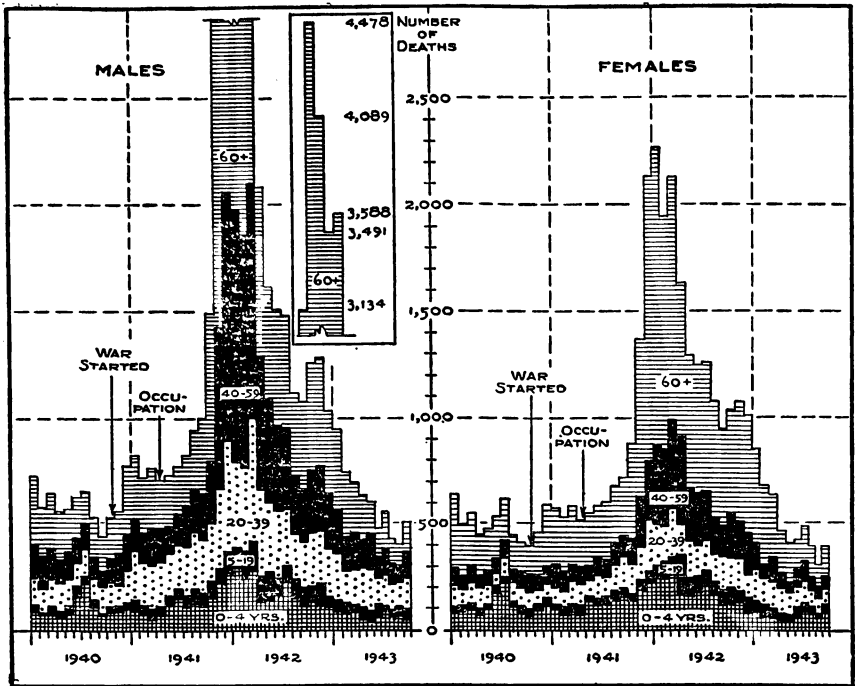


Fig. 2. Deaths by sex and age groups in Athens and Piraeus, 1940-1943.

mans over-ran the country. A few months later the deaths reached a peak six times higher than the normal, while births dropped to about one-third of the prewar level. Only after the arrival of the first imported provisions, which were distributed through the International Red Cross (April 1942), did the excessive mortality (mostly hunger deaths) begin to slow down. After a temporary increase in the number of births early in 1942, the downward trend in births continued until late in 1942. The two lines on their way to the normal did not cross again until March 1943, *e.g.*, two full years after their first deviation. During this period the deficit in births totaled about 14,000, or over one-third of the number of live births expected.

In December 1944, the month of the civil war, the two lines crossed once more, this time quite momentarily. It was due not so much to the erroneous drop of births — there were fewer

registrations not fewer births — but to the increased mortality in the war-torn area of the Greek Capital.

The decrease in the number of births during the famine period is attributed not only to the numerous miscarriages and abortions observed during that time, but mostly to a physiological sterility which perhaps affected both parents but was most evident in women. Menstruation was temporarily suspended in more than 70 per cent of adult females.

The sex and age distributions of the deaths are shown in Table 2 and Figure 2. Two striking facts come out of this comparison: first, the considerably lower mortality of the females which in some months of the famine period was only one-half that of males; and second, the relatively small increase in the mortality at young ages in comparison with the heavy losses inflicted upon more senior members of the community during the famine.

We can only conjecture an explanation of these interesting facts. It may be that the female is stronger and more adapted to sustain herself to the exposure of a long starvation or that the Greek family, with its traditional unity, was sparing the housewife by giving her additional protection.

Both these hypotheses seem to be real facts. Mature females, where the difference is mostly observed, may have derived a certain physiological protection from the absence of menstruation. An appreciable amount of energy was thus conserved, which enabled the organism to prolong life and eventually escape death. The other hypothesis of the family protection of women is reflected in the simultaneous protection of young children of both sexes whose mortality at the highest point was about three times the normal, while their mothers were succumbing at the rate of three to five times and their fathers were dying at a rate five to eight times the prewar level. An additional influence on the number of deaths of children under five years of age was the low birth rate in 1941 and 1942.

The primary factor in this excessive mortality of the Greek population was *starvation*; there was no other important epidemic complication as may be seen in Table 3 and Figure 3. With the exception of a small epidemic of typhus which occurred in the spring of 1942, and another of malaria which flared up a few months later, there was only a small increase in the mortality from infections and parasitic diseases which was due chiefly to an increase in deaths from tuberculosis. The same is true for deaths caused by diseases of the respiratory and digestive systems.

Table 3. Numbers of deaths in Athens and Piraeus of both sexes by cause (major divisions).

CAUSE	MONTH AND YEAR (BY HALF-YEARS)									
	1940		1941		1942		1943 <sup>2</sup>		1944 <sup>2</sup>	
	Jan.- June	July- Dec.	Jan.- June	July- Dec.	Jan.- June	July- Dec.	Jan.- June	July- Dec.	Jan.- Feb.	
Infectious and Parasitic Diseases:	1,764	1,721	2,009	2,409	3,205	3,313	1,805	1,429	524	
Typhoid	12	59	38	60	26	81	16	59	4	
Typhus	—	—	—	—	42	11	—	—	—	
Malaria	2	23	13	20	7	205	11	15	1	
Tuberculosis	1,287	1,244	1,498	1,820	2,588	2,425	1,468	1,105	389	
Respiratory System	907	622	910	1,226	1,681	862	486	288	253	
Digestive System	580	892	756	2,240	1,425	1,966	294	578	89	
Circulatory System	799	614	822	1,612	1,463	894	599	397	245	
Nervous System	683	568	720	958	848	548	306	284	125	
Genito-Urinary	434	391	438	964	868	604	268	215	76	
Cancer	490	500	424	540	359	359	243	348	89	
Senility	350	288	460	1,771	2,178	963	401	226	112	
Violent Deaths	135	201	632	4,884	13,827	3,859	506	586	372	
Ill-defined	240	243	347	1,053	624	279	204	102	62	
<b>Total Deaths<sup>1</sup></b>	<b>6,880</b>	<b>6,468</b>	<b>7,916</b>	<b>18,280</b>	<b>26,924</b>	<b>13,887</b>	<b>5,330<sup>2</sup></b>	<b>4,649<sup>2</sup></b>	<b>2,057<sup>2</sup></b>	

<sup>1</sup> Deaths from rheumatism and some other diseases are not given in this table but are included in the totals.

<sup>2</sup> Deaths in 1943 and 1944 are for only 72 per cent of the total population of Athens and Piraeus. (See footnote to Table 1.)

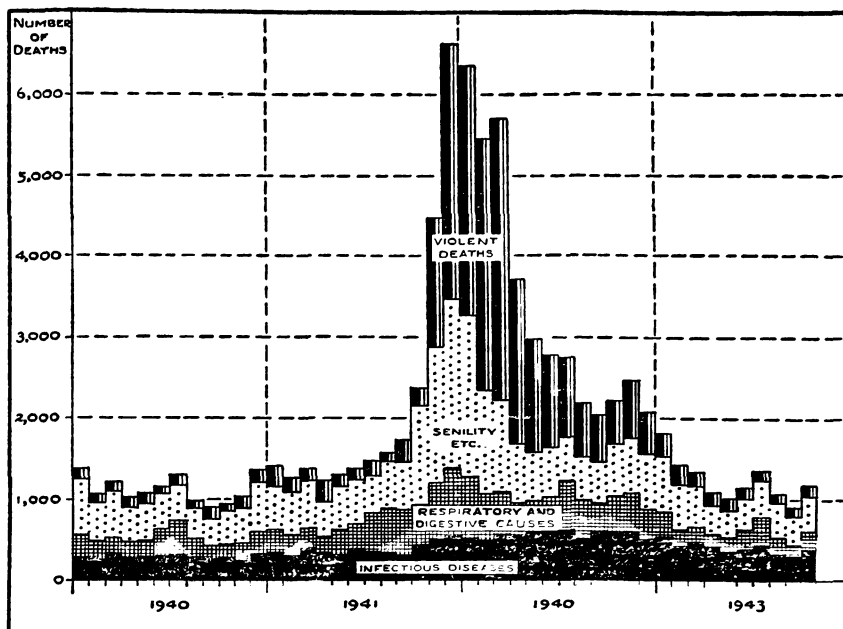


Fig. 3. Numbers of deaths by broad groups of causes in Athens and Piraeus, 1940-1943.

Hunger was the sole primary cause of death in tens of thousands of Athenians during that time. Deaths ostensibly due to heart failure, senility, etc., were in the great majority of cases expedited by the hunger famine of the period under review. This is clearly shown in Figure 3, in which the height of the ordinates representing the violent deaths — which include the hunger deaths — is greatly magnified during the famine period. This increase is accompanied closely by deaths from senility, etc., in which, however, the primary factor was again hunger.

The period of intensive starvation in Athens and Piraeus is examined more closely in Table 4 and Figure 4, which show the total deaths and deaths due to starvation occurring within the narrow limits of the City of Athens during successive seven-day periods from October 1, 1941 to April 28, 1942 together with the daily bread rations (the only food given at that time to the population) and the daily mean air temperature of Athens.



Table 4. Number of deaths from all causes and from starvation by seven-day periods, the daily bread ration, and the mean daily temperature in Athens during the famine period, October 1941 to April 1942.

DATE OF 7-DAY PERIOD	NUMBER OF DEATHS		BREAD RATION—GRAMS FOR EACH DAY OF WEEK							MEAN TEMPERATURE EACH DAY CENTIGRADE						
	Total	Hunger	W	T	F	S	S	M	T	W	T	F	S	S	M	T
Oct. 1-7	106	9	96	96	96	96	96	96	96	19.1	17.7	14.6	15.7	17.3	19.1	17.5
8-14	228	10	96	96	96	0	0	192	128	16.8	17.0	13.1	10.3	9.7	10.4	9.2
15-21	256	3	128	128	128	160	160	128	128	11.8	12.8	11.9	6.2	1.8	3.9	7.4
22-28	254	9	0	160	160	160	160	160	160	8.0	10.4	12.8	13.2	15.3	16.9	12.9
29-Nov. 4	292	7	160	160	160	128	96	128	128							
Nov. 5-11	327	24	0	128	128	0	128	96	96	19.1	17.7	14.6	15.7	17.3	19.1	17.5
12-18	425	47	96	96	96	0	0	128	128	16.8	17.0	13.1	10.3	9.7	10.4	9.2
19-25	580	159	0	0	0	0	96	96	0	11.0	11.4	12.7	10.7	10.1	11.4	11.3
26-Dec. 2	791	313	96	0	0	0	0	0	0	7.4	4.6	3.3	4.7	6.2	7.4	5.3
Dec. 3-9	967	408	160	96	160	160	160	160	160	4.5	4.3	6.1	6.4	4.6	4.6	10.1
10-16	742	267	160	160	160	160	160	128	128	8.4	10.2	11.5	10.3	9.6	9.6	11.2
17-23	566	150	128	128	128	128	128	128	128	12.1	12.9	15.5	11.5	9.5	6.4	7.2
24-30	641	196	192	192	192	128	128	128	128	6.8	10.3	10.7	-0.5	4.7	2.9	-0.1
31-Jan. 6	821	266	128	192	160	160	160	160	160	1.6	-1.4	2.8	0.9	2.3	5.2	9.8
Jan. 7-13	736	329	160	160	160	160	160	160	160	10.5	13.7	9.8	9.3	8.3	8.7	6.6
14-20	577	106	160	160	160	160	160	160	160	8.9	10.1	9.9	8.8	8.1	8.6	8.3
21-27	623	199	128	128	128	128	128	128	0	5.5	4.9	4.7	1.7	7.1	11.6	8.9
28-Feb. 3	823	370	0	128	128	0	0	0	0	1.8	2.7	5.1	5.0	7.5	8.0	7.3
Feb. 4-10	775	338	0	128	128	160	160	160	128	7.0	6.2	9.7	13.8	13.0	11.4	12.8
11-17	546	197	128	128	96	96	96	96	96	11.5	11.1	11.3	9.1	9.4	10.4	9.8
18-24	650	266	96	96	96	96	96	96	96	8.3	6.6	5.4	5.7	6.0	7.1	13.4
25-Mar. 3	684	277	0	0	96	0	0	0	0	14.4	12.2	13.7	12.9	10.7	11.2	10.5
Mar. 4-10	669	329	0	0	160	160	256	160	160	9.5	10.4	11.9	11.9	10.6	10.7	10.5
11-17	565	283	160	160	160	160	160	160	160	11.8	10.8	13.1	11.0	12.1	11.4	12.1
18-24	575	264	160	160	160	160	160	160	160	13.0	12.8	11.9	6.2	1.8	3.9	7.4
25-31	626	100	256	160	160	160	160	256	160	8.0	10.4	12.8	13.2	15.3	16.9	12.9
Apr. 1-7	511	244	160	160	160	160	256	256	160							
8-14	399	203	160	160	160	160	256	160	160							
15-21	463	200	160	160	160	160	256	160	160							
22-28	403	174	160	256	160	160	256	160	160							

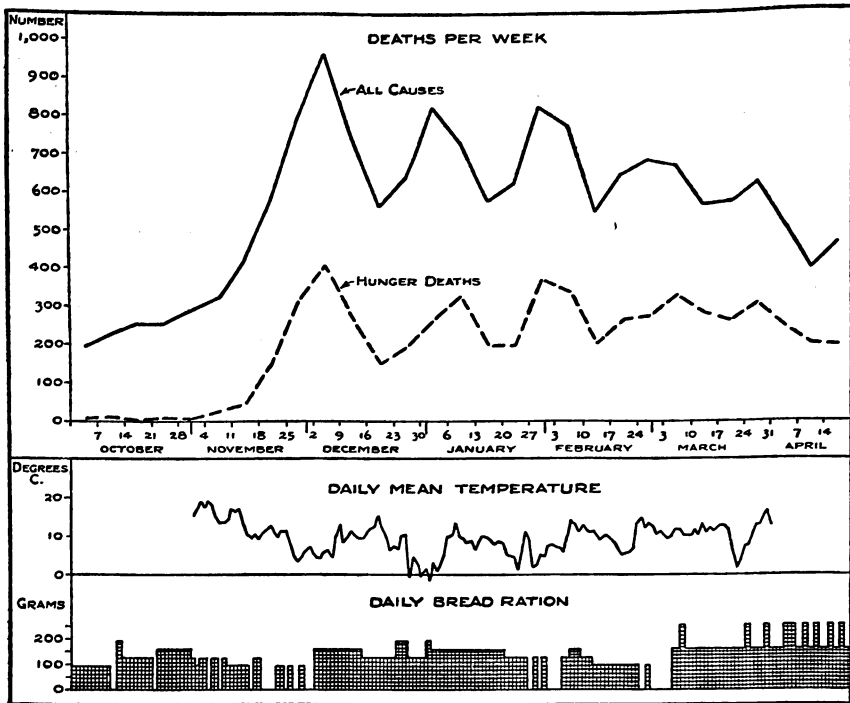


Fig. 4. Numbers of deaths by weeks from all causes and from hunger, the bread ration issued daily, and the daily mean temperature in the City of Athens during the period of acute famine, October 1941-April 1942.

It will be seen that the deaths take the form of successive epidemic waves with "hunger deaths" preminent as the common factor. The peaks of these waves did not always coincide with each one of the frequent interruptions in the bread rations given to the population. Deaths, however, did coincide with the "cold waves" which are clearly shown in the lower part of Figure 4 by the line for the average daily temperature. The conclusion appears inevitable that the extreme undernourishment prevailing amongst the population in association with the drop in the air temperature resulted in a mass mortality of the starving and much weakened population. A caloric intake insufficient for normal weather conditions became grossly inadequate following the extra expenditure of energy during the cold spells.

During the two years of the famine the total losses from excess mortality and reduced natality in Athens and Piraeus exceeded 60,000 persons. If we extend this damage on equal terms for the country as a whole (in fact, many districts of Greece were more subjected to famine conditions), we estimate that Greece lost about 450,00 human beings because of acute privations resulting from lack of essential food during the early months of the German occupation.

The three main points of this war famine of Greece may be summarized as follows:

- a. The acute manifestations of the famine lasted for two complete years (May 1941 - April 1943).
- b. It affected adult males more than women and children.
- c. It was not complicated with any severe epidemic or non-epidemic disease.

#### B. POST FAMINE — SOMATOMETRIC DATA ON CHILDREN

A. *Height and Weight.* Somatometric data on the Greek population is so far scanty and mostly unreliable. The most authoritative source of prewar somatometric data is that of Professor Exarchopoulos and Miss Gedeon obtained from school children for the period 1927-1928. In their publication the mean values for height and weight are given on 50,000 measurements with no specifications as to the number examined in each sex-age group or the amount of dispersion of the observations around the mean. The mean values, shown in Table 5, are used for comparison with postfamine measurements.

In the second half of 1942 and the first months of 1943, in collaboration with Dr. Ser. Papaioannou, we made measurements of the body weight and the height of school children living in and around the capital area. We endeavored to collect a large number of measurements to ascertain the effect, if any, of the famine which was still prevailing in an attenuated form among the popu-

AGE	HEIGHT—Cms.		WEIGHT—Kgs.	
	Boys	Girls	Boys	Girls
Birth	51.1	50.2	3.5	3.2
1	58.7	55.7	11.2	6.9
2	75.9	65.9	13.1	10.3
3	86.3	79.6	15.8	13.7
4	95.9	91.9	15.8	14.4
5	100.2	100.7	15.9	17.9
6	106.5	105.5	20.6	19.2
7	111.7	111.5	21.5	22.1
8	117.1	115.0	24.9	24.8
9	121.3	122.0	26.5	26.4
10	127.1	126.2	28.2	30.2
11	130.8	132.0	31.1	35.1
12	136.0	137.6	35.0	37.4
13	141.1	142.2	40.2	42.3
14	148.4	147.0	46.4	48.5
15	156.5	152.6	49.8	48.9
16	163.3	153.5	53.1	50.7
17	166.2	153.9	56.3	52.7
18	167.0	155.7	—	56.0
19	167.8	155.7	57.1	—
20	—	156.5	—	—

Table 5. Height and weight of Greek children, measured by Professor Exarchopoulos in 1927-1928.

lation. Unfortunately, the survey came to an end prematurely because of Dr. Papaioannou's departure from Greece, and data for only 9,461 boys and 4,972 girls were collected and analyzed. The results derived from these data have been incorporated in Table 6 with similar data derived from a second and more extended survey made one year later (1944) and from a third survey in Piraeus in the spring of 1945. The 1944 and 1945 surveys were made by a group of scientists<sup>2</sup> working under the auspices of the Institute of Social Insurance.

Comparison of the average heights of children measured in the

<sup>2</sup> This group consisted of Mr. M. Goutos, Director, Social Insurances; Dr. D. Orphanos, President, Panhellenic Medical Association; Dr. D. Stefanou, Director, Ministry of Education; Dr. G. Livades, Director, School of Hygiene; Dr. K. Choremis, Professor of Paediatrics, University of Athens; and Dr. V. Valaoras, Associate Professor of Hygiene, University of Athens.

Table 6. Height and weight of Greek children from Athens and surrounding towns during the period 1942-1945.<sup>1</sup>

YEAR AND AGE AT NEAREST BIRTHDAY	BOYS						GIRLS							
	Number	Height			Weight			Number	Height			Weight		
		Mean	St. Error	S. D.	Mean	St. Error	S. D.		Mean	St. Error	S. D.	Mean	St. Error	S. D.
1942 Birth	772	50.4			3.26			725	49.6			3.09		
1944														
1	3,949	71.2	0.1	5.4	8.88	0.04	2.38	3,710	69.9	0.1	4.9	8.04	0.02	1.23
2	1,997	82.3	0.1	6.0	11.56	0.04	1.72	1,871	81.3	0.1	5.8	11.10	0.04	1.68
3	2,194	90.7	0.1	5.4	13.62	0.04	1.88	2,006	89.5	0.1	5.3	13.10	0.04	1.76
4	2,737	96.7	0.1	5.4	15.38	0.04	1.93	2,485	95.9	0.1	5.4	14.95	0.04	2.00
5	2,788	102.4	0.1	5.6	16.86	0.04	2.09	2,697	102.1	0.1	5.5	16.52	0.05	2.11
6	2,448	108.4	0.1	5.6	18.62	0.05	2.24	2,555	106.8	0.1	5.6	18.10	0.05	2.32
7	1,335	112.3	0.1	5.4	18.76	0.09	3.03	1,333	112.8	0.1	5.8	19.52	0.06	2.36
1942-1943														
8	257	118.8	0.4	5.6	21.87	0.18	2.82	238	118.5	0.4	5.5	21.49	0.20	3.03
9	308	124.2	0.4	6.6	24.11	0.20	3.45	312	123.7	0.4	6.4	23.91	0.19	3.34
10	447	129.7	0.3	7.2	27.34	0.23	4.87	374	128.6	0.4	7.1	26.43	0.24	4.56
11	898	135.5	0.2	7.0	30.91	0.17	5.02	598	134.4	0.3	5.9	29.87	0.23	5.62
12	1,290	140.1	0.2	7.7	33.53	0.15	5.46	698	140.3	0.3	8.3	33.73	0.25	6.74
13	1,400	144.5	0.2	8.4	36.40	0.16	5.94	682	146.1	0.3	8.5	38.52	0.28	7.41
14	1,178	151.0	0.3	9.5	41.04	0.22	7.49	564	150.8	0.3	7.5	43.83	0.31	7.35
15	1,049	158.6	0.3	9.6	47.11	0.26	8.45	447	154.2	0.3	6.6	47.77	0.35	7.38
16	839	164.4	0.3	8.4	52.95	0.28	8.02	445	156.4	0.3	5.8	52.14	0.31	6.47
17	778	168.1	0.3	7.3	59.43	0.29	8.02	325	158.3	0.3	5.8	54.38	0.32	5.78
18	519	170.4	0.3	6.6	60.16	0.30	6.92	149	158.7	0.4	5.5	56.19	0.47	5.67
19	220	170.7	0.4	5.7	60.20	0.45	6.67							
20	107	171.7	0.6	6.0	62.50	0.56	5.76							
1945														
7	351	115.9	0.4	5.8	20.23	0.11	2.95	356	115.5	0.3	6.0	20.19	0.16	3.15
8	585	118.9	0.2	5.4	21.78	0.13	3.11	555	118.4	0.2	5.5	21.54	0.14	3.36
9	728	123.4	0.2	6.1	23.60	0.12	3.32	696	122.4	0.2	6.0	23.13	0.13	3.39
10	880	127.2	0.2	5.7	25.52	0.11	3.41	877	126.9	0.2	6.1	25.40	0.12	3.62
11	942	131.5	0.2	6.1	27.63	0.12	3.71	965	131.6	0.2	6.3	28.03	0.13	4.12
12	978	135.3	0.2	6.5	30.09	0.13	4.14	986	136.7	0.2	7.1	30.97	0.15	4.73
13	672	138.6	0.3	7.0	31.83	0.18	4.66	597	139.8	0.3	8.0	33.28	0.22	5.58
14	376	143.0	0.4	8.1	34.81	0.28	5.43	201	143.1	0.5	7.5	35.13	0.40	5.72

<sup>1</sup> Measurements at birth were made by Professor D. Antonopoulos in 1942 at the Athens Maternity Hospital. Data for ages 8 to 20 years in 1942-1943 are from measurements made by Dr. Papaioannou and the author. Data for 1944 and 1945 are from surveys made by a group at the Institute of Social Insurances in which the author participated.

period from 1942 to the spring of 1944 with average heights obtained in 1927-1928 indicates that Greek children were slightly taller than they had been fifteen years earlier. Comparison of the average weights shows that during these years of the occupation, the children were appreciably lighter than in the prewar period. This reduction in body weight was anticipated, of course, because of the famine and the consequent severe malnutrition of the child population. Measurements from the 1945 survey indicate that the continued undernutrition had affected growth as well as weight and the children were shorter and lighter than those of similar age measured two to two and a half years previously.

The differences between the mean heights and weights of children measured in 1927-1928 and in the later surveys are shown in Figure 5 for each year of age and indicate more clearly the "gain" or "loss" in height and weight of children in the war years. The increase in height at ages 1 and 2 years in 1944 is so great that it is doubtful that the measurements are comparable with those for 1927-1928 and height and weight changes shown in Figure 5 are for boys and girls aged 3 years and older.

The changes in heights and weights at specific ages as compared with the prewar mean values differ appreciably at different ages for both boys and girls, but several conclusions are suggested. In 1942-1943, some increase in height is shown for boys and girls at every age; for girls, the increase tends to be greater after age 11 years but for boys the increase declines consistently after age 11 years. Some increase in the average heights of children in years just preceding World War II has been reported from a number of countries and apparently this trend was characteristic also of Greek children. It is not possible to determine whether the famine years had retarded growth by 1942-1943 but the consistent decline in height increase for boys from age 11 to 17 years, normally a period of rapid growth, suggests that some retardation of growth had occurred. By 1945, retardation in growth is striking

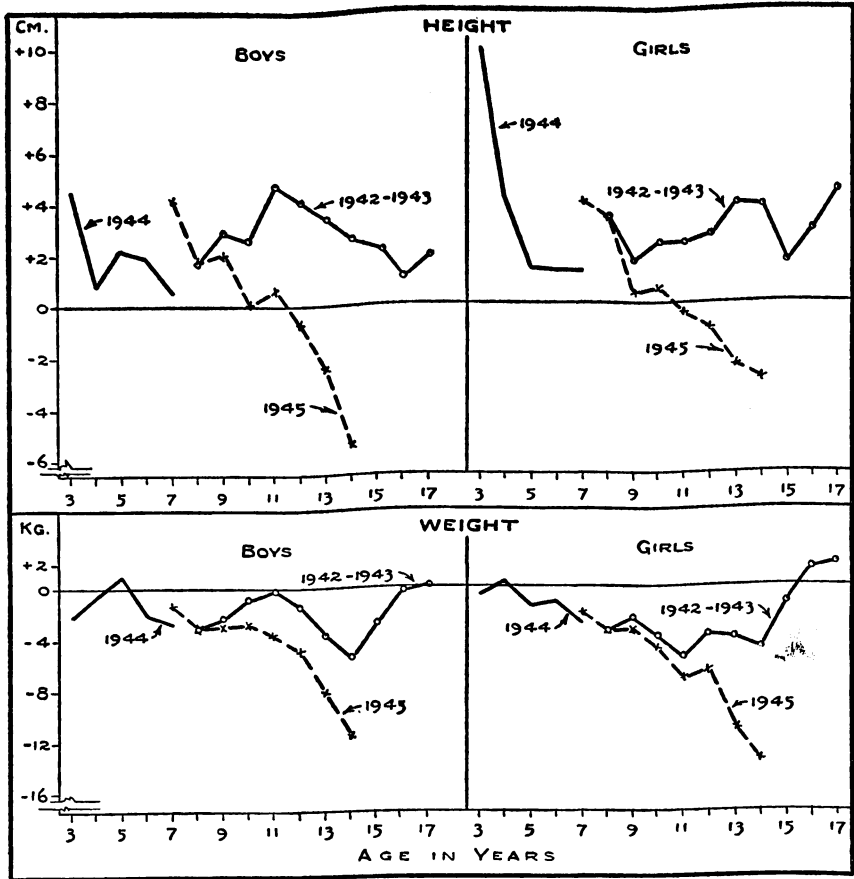


Fig. 5. Increase or decrease in mean heights and in mean weights of boys and girls measured during the war years from mean heights and mean weights obtained in 1927-1928.

for both boys and girls and increases at successively older ages from 10 to 14 years.

In spite of greater average height in 1942-1943 than in 1927-1928, the average weight was less at nearly every age under 16 years of age for both boys and girls. At most ages, girls show greater loss of weight than boys. In 1945, further loss of weight is indicated. This loss was greater proportionally than the decrease in height at corresponding ages, as is shown by comparing the weight-height ratios as follows: average kgs. of weight per

100 cms. of height for boys aged 14 years were 31, 27 and 24, and for girls were 33, 29 and 25 in the surveys made in 1927-1928, 1942-1943, and 1945, respectively. Thus, the condition of the children, especially those from 11 to 14 years of age, appears to have become progressively worse as a result of the prolonged malnutrition.

B. "*Pelidisi*" Index. The Pelidisi (Pondus decies lineare divisio sedentis altitudo) index of von Pirquet, which is supposed to express the nutritional status of an individual has the following form:

$$\text{Pelidisi} = \sqrt[3]{\frac{10 \cdot W}{S. H.}}$$

where W stands for weight and S.H. for sitting height.

Two sources of information on the above subject are available from Greece. The first refers to 55,764 children aged 1 to 17, examined during the spring of 1943 in the childrens' canteens of Athens, under the supervision of Dr. H. Korrodi of the Swiss Mis-

Table 7. Pelidisi index for Athenian children (both sexes) examined by Dr. H. Korrodi of the Swiss Mission in 1943.

AGE IN YEARS	NO. OF CHILDREN	MEAN INDEX	PER CENT WITH SPECIFIED PELIDISI			
			Total	Less Than 96	96-100	101 or More
1-2	577	100.6	100.0	14.9	35.7	49.4
3	3,067	100.2	100.0	19.9	34.6	45.5
4	4,097	99.1	100.0	22.5	40.9	36.6
5	4,429	98.1	100.0	30.1	39.8	30.1
6	4,841	96.1	100.0	47.2	34.7	18.1
7	5,282	95.8	100.0	50.4	35.1	14.5
8	5,804	95.3	100.0	55.2	33.1	11.7
9	5,205	95.1	100.0	56.3	33.7	10.0
10	5,684	95.0	100.0	57.0	33.2	9.8
11	4,567	95.0	100.0	57.6	32.2	10.2
12	5,252	95.0	100.0	56.9	33.7	9.4
13	3,937	95.2	100.0	55.6	34.2	10.2
14	2,385	95.5	100.0	53.3	33.8	12.9
15-17	637	97.0	100.0	39.9	39.8	20.3



sion in Greece. The analysis of these data was prepared by the writer. The second source comes from the same research made in 1944 by the Social Insurance group referred to above, on a total number of 11,231 boys and 11,020 girls aged 2 to 7 years. The number examined and the mean Pelidisi at each age for these studies are given in Tables 7 and 8 and the change in the mean values with age is shown in Figure 6.

In the 1943 survey, the Pelidisi index, which in the first 2 or 3 years of age stands at a normal level, rapidly drops after this age to reach the lowest point at the age of 10 to 12 years. The condition of older children looks somewhat better as most of these were accustomed at that time to go out for work or at least they were able to look after themselves during the critical months of the acute famine. Young babies up to 2 years of age were also

Table 8. Pelidisi index for Athenian boys and girls examined by the Social Insurance Group in 1944.

AGE IN YEARS	No. OF CHILDREN	MEAN INDEX AND ST. ERROR	STANDARD DEVIATION	PER CENT WITH SPECIFIED PELIDISI			
				Total	Less Than 96	96-100	101 or More
BOYS							
2	1,422	98.7 ± 0.2	6.1	100.0	28.4	35.0	36.6
3	1,846	97.9 ± 0.1	5.4	100.0	34.3	36.9	28.8
4	2,274	97.1 ± 0.1	5.5	100.0	42.1	33.5	24.4
5	2,288	96.0 ± 0.1	5.3	100.0	51.0	31.3	17.7
6	2,193	94.8 ± 0.1	5.0	100.0	62.3	25.9	11.8
7	1,208	94.7 ± 0.2	5.7	100.0	64.7	24.1	11.2
GIRLS							
2	1,255	99.3 ± 0.2	5.7	100.0	26.0	34.5	39.5
3	1,652	97.9 ± 0.1	5.4	100.0	34.4	36.2	29.4
4	2,185	97.3 ± 0.1	5.5	100.0	39.4	35.3	25.3
5	2,402	95.9 ± 0.1	5.0	100.0	49.5	34.9	15.6
6	2,252	94.9 ± 0.1	4.9	100.0	60.7	27.8	11.5
7	1,274	94.9 ± 0.2	5.6	100.0	62.2	24.9	12.9

well protected because of an adequate follow-up, and distribution of milk and other food. Those who suffered most were children over 7, and those who had not yet reached puberty. Very little

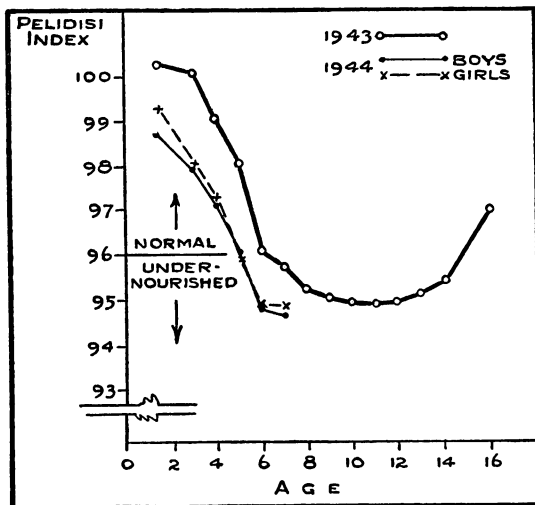


Fig. 6. The mean Pelidisi index at each year of age for children measured in 1943 and in 1944.

extra food was given for these children who were too young to take any care of themselves during that wild period of frantic search for any kind of food to save life.

Data from the two surveys, the one made by Dr. Korrodi in 1943, and the other of the Social Insurance group, carried out one year later in 1944, run parallel and act as controls on each other. The only difference is that the mean Pelidisi from the second survey is lower, indicating that nutrition of the people was aggravated during the period which elapsed between the two surveys.

The same results are observed in Figure 7 which shows the percentages at each age in the three groups: undernourished (Pelidisi below 96), normals (Pelidisi 96 to 100), and overnourished (Pelidisi over 100).

The percentages of children found to be undernourished on the first survey increased from 15 per cent at ages 1-2 years to 55 per cent at age 8 years, and remained fairly constant to age 14. At ages 15 to 18 years, the per cent decreased to 40<sup>3</sup>. The worst period is found again to be between the ages of 7 and 14 years.

<sup>3</sup> Editor's Note. Variation with age in the percentage of children having a Pelidisi of 94 (Continued on page 233)

The normally fed children are about one-third of the total at all ages. Overfed children who in the first year are 40 per cent to 50 per cent of the total number, decrease in percentage quickly to about 10 per cent at ages 8 to 14 years, and increase slightly after 15 years of age.

In the second survey, in 1944, the percentages in the undernourished class at ages 2 to 7 years are consistently higher than for the same age in the 1943 survey. The per cents increase from 28 for boys and 26 for girls aged 2 years to 65 and 62 for boys and girls, respectively, aged 7 years.

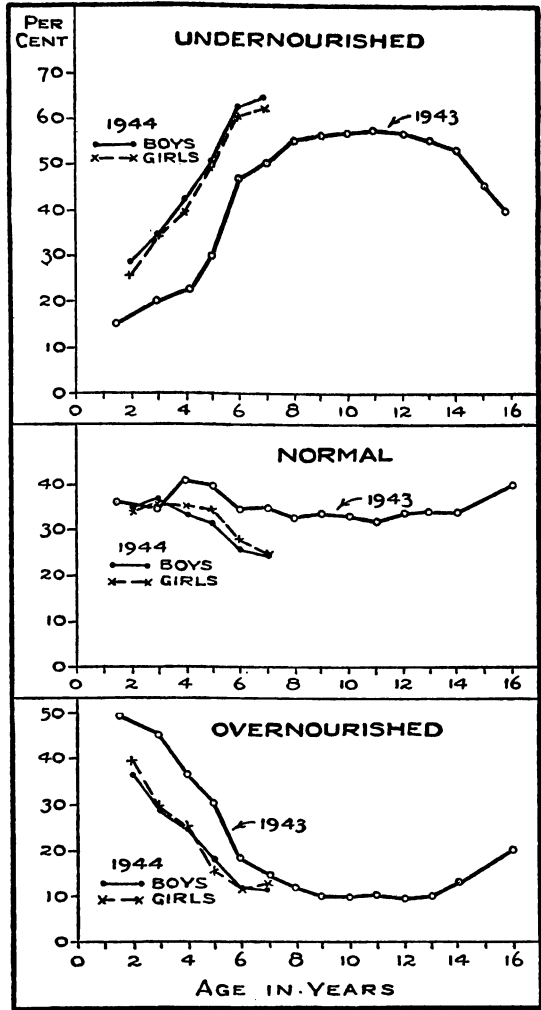


Fig. 7. Percentages of children examined in 1943 and in 1944 classified according to the Pelidisi index as undernourished (index below 96), normally fed (index 96-100), and overnourished (index 101 or more).

or less was reported by Clark, Sydenstricker, and Collins, who applied the Pelidisi standard to school children in the United States classified by physicians as in "good" or "excellent" nutrition. Age differences were as follows: 6-8 years, 26.6 per cent; 9-11 years, 21.7 per cent; 12-14 years, 12.7 per cent; and 15-18 years, 2.4 per cent. If this variation in the Pelidisi is applicable to Greek children, then the older children were actually more undernourished and not less so than the younger children. Cf. Clark, Taliaferro; Sydenstricker, Edgar; and Collins, Selwyn C.D.: Indices of Nutrition. *Public Health Reports*, 38, No. 23, June 8, 1923, pp. 1239-1270.

## SUMMARY

1. In two somatometric surveys made on children of the Athens area during 1942-1943 and 1944, and one survey in Piraeus in 1945, the effect of the previous famine (of 1941-1942) and the subsequent chronic malnutrition of the population is shown to have had marked effects on the population.

2. In the 1942-1943 survey, the children were somewhat taller but weighed less on the average than those of similar ages examined fifteen years earlier. In the 1945 survey, the average heights of children aged 8 to 14 years had decreased and at ages 12 to 14 years the children were shorter than in 1927-1928.

3. According to the Pelidisi index measured in a survey in 1943, babies up to the age of 3 years were almost normally fed because of the elaborate system of baby-feeding stations organized during the occupation period; children from 4 to 14 years of age showed marked undernourishment (over 50 per cent of those aged 7-14 years); older children (over 14 years of age) were in a slightly better condition.

4. The Pelidisi index for children aged 2 to 7 years obtained in a 1944 survey, indicated that the nutrition of children was worse than one year earlier. No marked difference is observed between the nutritional status of boys and girls.