

Methodology of National Turkey Nutrition and Health Survey (TNHS) 2010

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ABSTRACT

The purpose of this paper is to explain the methodology of National Turkey Nutrition and Health Survey (TNHS) – 2010. The survey was conducted with the aim of providing the necessary data on nutrition and health to plan and develop related food, nutrition and health policies in Turkey and the study was conducted in collaboration with Ministry of Health, Hacettepe University Faculty of Health Sciences Department of Nutrition and Dietetics, and Ankara Numune Training and Research Hospital.

TNHS sample was designed as a weighted, multi-stage, stratified cluster sample. To stratify the sample, TNHS adopted the stratification approach used in the 2008 Turkey Demographic and Health Survey that allows making estimates nation-wide and for the 5 regions, the 12 NUTS-1 regions, and the 7 metropolitans. Survey provided detailed information on dietary intake, physical examination including clinical and biochemical variables, physical activity status and anthropometric measurements. The survey sample was designed to represent the population of Turkey in age groups of 0-5 and ≥6 years, the baseline nutrition and health status and blood and urine tests of ≥6 year-old individuals.

Key words: Methodology, National Turkey Nutrition and Health Survey (TNHS) – 2010, dietary intake, nutrition habits, physical examination, biochemical parameters, anthropometric measurements

INTRODUCTION

National Turkey Nutrition and Health Survey (TNHS)-2010 is a study that aims to document the nutrition and general health status of Turkey. The 2010 is conducted in collaboration with Ministry of Health, Hacettepe University Faculty of Health Sciences Department of Nutrition and Dietetics, and Ankara Numune Training and Research Hospital. After a long duration of planning and organization processes, and training of the field workers in February 2010, the study was conducted in the field by 2010 summer, which entails completing surveys, dietary intakes, anthropometric measurements, physical examinations, and biological sample collections. This article further explains the methods and materials used in this study.

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MATERIALS AND METHODS

Sample Design and Allocation

TNHS sample was designed as a weighted, multi-stage, stratified cluster sample.

The survey sample was designed to represent Turkish population in terms of nutritional habits of individuals in age groups of 0-5 and ≥ 6 years, the baseline nutrition and health status and blood and urine tests of ≥ 6 year-old individuals. Additionally, it was also suitable to make inferences for urban/rural and/or in a 12 region domains.

The Survey sample units are the households in Turkey and the population living in these households. In the scope of the study aims, the surveys were applied using 3 different questionnaires suitable for the age groups of 0-5, 6-11, and ≥ 12 years. The household interviews were conducted using the household lists randomly selected from the National Address Database of Turkish Statistical Institute (TURKSTAT). At these households, 2 sets of interviews and tests were conducted with one 0-5 year-old and one ≥ 12 year-old individual selected via "Kish" method, where possible.

The sample frame used in the study for sample selection and allocation is the 2008 Address Based Population Registration System (ABPRS) of TURKSTAT. The information on the households to be visited was selected by TURKSTAT from the National Address Database using sampling techniques. This dataset includes information such as neighborhood name, street name, and residential address for every settlement listed under a municipality in Turkey; and has been compiled and updated by TURKSTAT within collaboration with the municipalities. TURKSTAT does not always have information suitable for sample selection for the rural settlements outside the areas aforementioned (those within municipalities). Therefore, the sample frame for these settlements was formed during the field work, as discussed in the following sections.

To stratify the sample, TNHS adopted the stratification approach used in the 2008 Turkey Demographic and Health Survey that allows making estimates nation-wide and for the 5 regions, the 12 NUTS-1 regions, and the 7 metropolitans (1).

In TNHS, based on the 2008 ABPRS, settlements with population less than 10000 were defined as rural and those with population of 10000 or more were defined as urban. Twelve NUTS-1 regions were developed during the EU compliance processes and are the 12 regions that constitute the first tier of the Statistical Region Classification System that are used as official statistics.

The Turkey Nutrition and Health Survey 2010 (TNHS 2010) was conducted with the aim of providing the necessary data on nutrition and health to plan and develop related food, nutrition and health policies in Turkey. Beyond being an epidemiological study with the aim of working on experimental and/or pre-defined hypothesis tests of a limited number of variables, TNHS 2010 was also designed to produce estimates on nutrition and related health indicators on nationwide, rural/urban, and regional scales. As in similar studies around the world, many calculations were made for the TNHS 2010 study's sample design and sample size calculation too. Among these were prevalence of certain variables and the associated tolerance values (95% confidence interval; $\alpha = 0.05$), including non-response and design effect adjustments and resulting in different sample sizes. The target sample size of approximately 19000 households were calculated, taking into consideration not only the sampling errors but errors outside of sampling such as those related to Survey budget and timing, the Survey teams capacity and formation, questionnaire details, sensitive variables such as anthropometric measurements and those time sensitive parameters such as blood and urine samples; that can be used to make estimates based on the prevalence of $p = 0.15$ (roughly the assumed obesity rate at time of design), both nationwide within a confidence interval (0.14; 0.16) (relative error $CV=0.03$) and for the NUTS-1 regions within a confidence interval (0.12; 0.18) (relative error $CV=0.11$). Within these calculations the design effect was 2.0 and the total non-response adjustments based on the NUTS was considered to vary between 1.52 and 2.35.

Calculations are presented in Tables 1 and 2.

The target sample size was 19056 households in the study. This sample design could allow for making estimations nationwide, urban/rural areas, 12 NUTS-1 regions, and the 7 metropolitans. The study was conducted in 600 clusters in 81 city (province) centers with 36 urban and 24 rural households. The goal was to visit 13968 urban and 5088 rural households.

As the first step in TNHS sampling, the locations of the 600 clusters were selected using random probability sampling methods. There were different numbers of urban and rural clusters in the sample from the 81 cities/provinces.

As a second step, the address lists called the block lists were obtained using the TURKSTAT National Address Database for the settlements that have address information, via random selection again, and these lists were prepared by the TURKSTAT.

TABLE 1: TNHS2010 Target Sample Size Calculation*

Region	P	Tolerance	DEFF	General non-response rate	Estimated number of individuals	Number of Targeted household	CV (%)	Lower Limit	Upper Limit
Istanbul	0.15	0.03	2	2.35	873	2047	0.11	0.12	0.18
Western Marmara	0.15	0.03	2	1.70	873	1481	0.11	0.12	0.18
Aegean	0.15	0.03	2	1.81	873	1583	0.11	0.12	0.18
Eastern Marmara	0.15	0.03	2	1.94	873	1690	0.11	0.12	0.18
Western Anatolia	0.15	0.03	2	1.70	873	1480	0.11	0.12	0.18
Mediterranean	0.15	0.03	2	1.69	873	1472	0.11	0.12	0.18
Mid-Anatolia	0.15	0.03	2	1.99	873	1737	0.11	0.12	0.18
Western Black Sea	0.15	0.03	2	1.91	873	1669	0.11	0.12	0.18
Eastern Black Sea	0.15	0.03	2	1.84	873	1606	0.11	0.12	0.18
Northeastern Anatolia	0.15	0.03	2	1.69	873	1479	0.11	0.12	0.18
Mid-eastern Anatolia	0.15	0.03	2	1.64	873	1428	0.11	0.12	0.18
Southeastern Anatolia	0.15	0.03	2	1.52	873	1328	0.11	0.12	0.18
TOTAL	0.15	0.01	2	1.79	10475	18999	0.03	0.14	0.16

*The numbers have small differences compared to the table below due to the rounding made according to sample distribution and conversions to double-cluster numbers.

The block lists provided by TURKSTAT consist of 106 (36*3) and 72 (24*3) households for the urban and rural clusters, respectively. The third step entailed choosing one individual from every 3 households, and contacting the household for a study visit.

TURKSTAT-prepared lists were handed out to every team. These lists consist of 36 lines in urban clusters and 24 in rural, where each line includes the selected and to-be-visited household listed with address and code information. For villages that TURKSTAT could not provide address information for, the listing for the selected and visited houses was done in the field for 24 households, following a probability selection method.

Field Application and Response Rates

TNHS is not a survey that only uses a questionnaire, but adopts a method that also includes interviews with members of the household along with a series of other field applications including collecting anthropometric measurements data, conducting physical examinations, and obtaining blood and urine samples from the selected individuals.

Therefore, higher target numbers were determined as a significant gap was expected between the number of target

households and interviews and the completed interviews due to reasons such as non-response, not getting the information aimed for, failure to administer the test, or refusal to participate in the study due to survey procedures.

Additionally, there were also errors that occur in classic household surveys due to address system errors, not being at home due to the season the survey is administered or mobility, refusal, high failure to get in contact within urban and especially metropolitan areas at cluster, household, and individual levels, and lower response rate of males on the individual level.

Table 3 and 4 displays the number of households, number of interviews, and the response rates by settlements and regions. The household response rate based on the number of households in the sample was 70.1% in urban settlements, 91.6% in rural and 76.1% across Turkey.

When examined by age groups, the response rate for 0-5 year-olds, who were eligible and participated in the interview, were 97.3% in urban settlements, 98.0% in rural settlements and 97.5% across Turkey. For the 6-11 year-olds, the response rates were 93.3% in urban settlements, 96.4% in rural settlements, and 94.4% across Turkey. For those of

TABLE 2: TNHS2010 Sample allocation, target households and number of clusters.

12 Regions (NUTS)	Number of clusters			Number of households		
	Urban	Rural	Total	Urban	Rural	Total
Istanbul	54	4	58	1944	96	2040
Western Marmara	30	20	50	1080	480	1560
Aegean	30	20	50	1080	480	1560
Eastern Marmara	30	18	48	1080	432	1512
Mediterranean	32	20	52	1152	480	1632
Western Anatolia	30	18	48	1080	432	1512
Mid-Anatolia	34	20	54	1224	480	1704
Western Black Sea	32	20	52	1152	480	1632
Eastern Black Sea	30	20	50	1080	480	1560
Northeastern Anatolia	30	18	48	1080	432	1512
Mid-Eastern Anatolia	28	18	46	1008	432	1440
Southeastern Anatolia	28	16	44	1008	384	1392
Turkey	388	212	600	13968	5088	19056

12 years of age and over, these response rates were high as 93.3, 96.4, and 94.4%, respectively. All age groups had a response rate over 90%. In other words, the response rates for TNHS2010 on both household and individual levels were considerably high.

The number of households and interviews by region and the corresponding response rates are presented in Table 4. The regions with highest household response rates were Aegean (87.6%), Northeastern Anatolia (83.4%), and Eastern Anatolia (83.2%). The individual interview response rates were over 90% in all regions.

Calculation of Sampling Weights

In order to have sufficient observations to make estimates for regional level and to consider the non-response, disproportionate allocation was applied. Sample weights were calculated per stratum and varied by age group and gender.

Calibrations were done by using the external data on age, gender, urban, rural and 12 NUTS-1 regions from 2010 ABPRS, in order to prevent the bias due to sample design and distribution, and non-response variance while making estimations. Estimations were made based on the following steps.

Calculation of weights per stratum

- f_1 : Probability of selection of blocks
- f_2 : Probability of selection of the selected 36 (24) households from the selected blocks after listing
- f_3 : Probability of selection of individuals within the selected household using Kish table (calculated per stratum)

$f = f_1 * f_2 * f_3$ final selection probability calculated per stratum
 $w = 1/f$ calculated weight per stratum

Calculation of non-response per stratum

First, the non-response adjustment per household is calculated.

$$R_{household} = \frac{\text{number of selected households} - \text{number of excluded households}}{\text{number of households responded}}$$

Next, the non-response adjustment coefficient for individual non-respondents was calculated (separately for gender, and 0-5 and 6 or over year-olds).

$$R_{individual} = \frac{\text{selected individual}}{\text{responded individual}}$$

Non-response adjustment was calculated by multiplying the household and individual non-response adjustments.

$$R = R_{household} * R_{individual}$$

Calculation of weights

$W = w * R$ was defined as the weight per stratum.

The final weights were calculated based on the calibrations and controls made on the estimations obtained using these weights. Table 5 displays the pre-calibration design weights and non-response rates.

Calibration

Calibration was made as follows: In order to test the consistency of sample distribution with external data based

TABLE 3: Results of household and individual interviews and response rates by households, TNHS 2010.

Results	Urban	Rural	Total
Household interviews			
Number of households in the sample	13968	5088	19056
Inhabited households	12593	4528	17121
Interviewed households	7739	3917	11656
Household response rate	70.1	91.6	76.1
0-5 year-old individuals interviews			
Eligible 0-5 year-olds	2214	1086	3300
Interviewed eligible 0-5 year-olds	2154	1064	3218
Eligible 0-5 year-old individuals response rate	97.3	98.0	97.5
6-11 year-old individuals interviews			
Eligible 6-11 year-olds	820	428	1248
Interviewed eligible 6-11 year-olds	793	417	1210
Eligible 6-11 year-olds individual response rate	93.3	96.4	94.4
12 years and over old individuals interviews			
Eligible 12 years and over olds	6919	3489	10408
Interviewed eligible 12 years and over olds	6455	3365	9820
Eligible 12 years and over old individuals response rate	93.3	96.4	94.4

on certain characteristics and to adjust the sample distribution based on the external data. Calibration was conducted in collaboration with TURKSTAT Sampling and Research Techniques Department.

Initially, as external data, gender based age group distributions were used. Next, the 12 NUTS-1 regions and urban/rural distributions were used. Based on these variables, the calibration was made via the following steps.

1. Gender based age-group distribution check

$$w_i^{(1)} = \frac{P_j}{P_j} \dots \dots \dots i \in j$$

P_j = 2010 population distribution of age groups based on gender

P_j = Distribution of gender-based age groups weighted with W

2. Region based urban/rural distribution check

$$w_i^{(1)} = \frac{P_j}{P_j} \dots \dots \dots i \in j$$

P_j = 2010 urban/rural population distribution based on region

P_j = Distribution of region-based urban/rural population weighted with W

$$W_j = w_i^{(1)} W$$

As a result, frequency and other tabulated analyses were conducted after adding these stratum-based and bias-preventing weights to existing data, making sure to optimally represent the whole sample.

SURVEY IMPLEMENTORS AND IMPLEMENTATION METHODS

Ministry of Health General Directorate of Primary Health Care conducted the TNHS 2010. Hacettepe University Faculty of Health Sciences, Department of Nutrition and Dietetics and Ankara Numune Training and Research Hospital have also contributed to the study.

An Executive Committee, Monitoring and Evaluation Committee, and a Sub-Study Committee were formed for the study. To carry out the study in each province, a Survey officer (Deputy Director of Provincial Health) and a Survey coordinator (usually Education Branch Manager) were appointed; and 99 teams were formed in 81 provinces of Turkey. Each team consisted of one team leader, one controller, one physician, four interviewers (dietitians, nurses, midwives, etc.) and one laboratory technician.

The staff to run the study in provinces (a total of 900 people) was trained between February 1st and 13th, 2010, in Antalya in two groups. The Survey officers (Deputy Director of Provincial Health) and Survey coordinator (Provincial Education Branch Manager) from each province (city) and

TABLE 4: Results of household and individual interviews TNHS 2010

Results		2010-TNHS response rates and household and individual interviews by regions												
		Istanbul	Western Marmara	Eastern Marmara	Western Anatolia	Medit	Mid Anatolia	Western Black Sea	Eastern Black Sea	North eastern Anatolia	Mid-east Anatolia	South Eastern Anatolia	Total	
Household interviews														
Number of households in the sample		2040	1560	1512	1632	1512	1704	1632	1560	1512	1440	1392	19056	
Inhabited households		1896	1424	1382	1492	1380	1514	1412	1389	1264	1291	1255	17121	
Interviewed households		1156	899	807	787	972	1109	1096	866	968	992	889	11656	
Household response rate		68.2	70.2	67.0	61.0	82.3	80.1	83.1	74.3	83.4	83.2	76.0	76.1	
0-5 year-old individuals interviews														
Eligible 0-5 year-olds		224	152	212	223	270	327	259	215	332	402	406	3300	
Interviewed eligible 0-5 year-olds		219	148	209	209	267	326	252	202	320	397	397	3218	
Eligible 0-5 year-old individuals response rate		97.8	97.4	98.6	93.7	98.9	99.7	97.3	94.0	96.4	98.8	97.8	97.5	
6-11 year-old individuals interviews														
Eligible 6-11 year-olds		70	114	88	109	98	119	83	143	137	155	1248		
Interviewed eligible 6-11 year-olds		68	64	63	84	107	95	111	82	139	133	154	1210	
Eligible 6-11 year-olds individual response rate		97.1	95.5	96.5	95.5	98.2	96.9	93.3	98.8	97.2	97.1	99.4	97.0	
12 years and over old individuals interviews														
Eligible 12 years and over olds		1086	832	1001	699	863	1011	977	783	825	855	734	10408	
Interviewed eligible ≥12 year-olds		1030	796	920	648	809	970	924	733	803	810	682	9820	
Eligible 12 years and over old individuals response rate		94.8	95.7	91.9	92.7	93.7	95.9	94.6	93.6	97.3	94.7	92.9	94.4	

TABLE 5: TNHS2010 Sample Design Weights and Non-response Factors.

Stratum	Inverse of Sampling Fraction	Household Level Response	Household Weight	0-5 years Level Respose	6+ years Male Response	6+ years Female Response
1	3579840/1944	1605/1067	2.129249	267/206	373/338	694/676
2	33577/96	90/89	0.271879	17/13	27/24	62/60
3	603969/1080	852/519	0.705686	128/103	190/176	329/317
4	387955/480	429/380	0.701394	52/45	145/138	235/229
5	827590/576	443/394	1.241793	135/113	185/153	209/202
6	912621/360	304/253	2.341477	89/67	119/104	134/123
7	651562/384	321/303	1.381769	68/55	150/140	153/151
8	241330/144	119/87	1.762084	28/21	40/35	47/45
9	198009/96	86/78	1.748099	21/16	30/30	48/47
10	451925/576	407/165	1.487658	65/54	65/63	100/98
11	743164/288	241/178	2.68558	63/54	80/63	98/89
12	194658/288	239/208	0.596985	59/43	89/84	119/116
13	311606/216	184/138	1.478565	38/32	52/47	86/85
14	141841/144	133/118	0.853413	38/26	51/48	67/65
15	1150980/576	418/169	3.799125	65/51	65/54	104/97
16	248262/432	369/203	0.802981	109/67	82/61	121/110
17	242319/144	119/71	2.168022	26/21	31/28	40/39
18	232071/480	385/344	0.415941	93/70	143/142	201/201
19	390726/504	357/244	0.871905	100/77	106/96	138/136
20	1272277/576	454/375	2.055571	129/99	157/142	218/204
21	694766/432	370/353	1.295778	133/91	156/147	197/191
22	603660/1224	962/730	0.499588	278/218	305/283	425/417
23	342112/480	422/379	0.610028	153/108	157/146	222/219
24	422639/792	616/492	0.513581	137/111	219/206	273/258
25	331382/336	297/278	0.809935	82/62	127/119	151/146
26	237931/360	279/208	0.681456	62/51	110/97	98/95
27	188104/144	127/118	1.080702	38/28	50/47	68/67
28	299612/1080	806/541	0.317703	175/138	227/203	314/297
29	350607/480	359/325	0.62021	80/64	130/125	195/190
30	208311/1080	823/645	0.189181	266/189	232/222	413/405
31	222490/432	337/323	0.413051	229/131	154/150	169/165
32	386567/1008	851/668	0.375549	344/236	253/222	415/409
33	287998/432	342/324	0.540924	287/161	124/114	200/198
34	274529/432	350/273	0.626267	164/111	129/108	144/140
35	649777/576	481/319	1.307509	212/135	128/122	191/183
36	377710/384	338/297	0.860471	287/151	119/111	178/172

8 people from each team took part in these trainings. Each team consisted of one team leader, one controller, one physician, four interviewers (dietitians, nurses, midwives, etc.) and one laboratory technician.

The field study was started on June 7, 2010 in every province of Turkey simultaneously, and continued until the end of July 2010 depending on the number of teams within the province (city). Of the 99 teams running the study, 19 teams worked in the field for 1 week, 18 for 2 weeks, 16 for 3 weeks, 22 for 4 weeks, 11 for 5 weeks, and 13 for 6 weeks.

The study coordinator was responsible for the coordination

of the study, the inter-team relations, arranging transportation vehicles, supplying and distributing materials, determining the study regions of the teams, and delivering the questionnaires and samples to the study center. The main duty of the controller was to check the questionnaires according to the instructions provided.

Interviewers job was to fill out the household and individual questionnaires, and to take the anthropometric measurements. The 1st interviewer filled out the individual questionnaires. At the same time, the 2nd interviewer obtained blood and urine sample from selected individuals, under doctors supervision.

TABLE 6: Workflow Chart

Introduction, first approval Household questionnaire application + available person for individual interview		Day 1 Day 2
A. The person is at home	B. The person is not at home	
<ol style="list-style-type: none"> 1. Put the person's ID information and barcode sticker on the questionnaire 2. Fill-in the individual questionnaire 3. Record anthropometric measurements 4. Inform the person about and make an appointment for blood and urine sampling 	<ol style="list-style-type: none"> 1. Make an appointment; inform the individual that a 7-hour fasting is required 2. Put the person's ID information and barcode sticker on the questionnaire 	
<ol style="list-style-type: none"> 1. Fill-in the physical examination questionnaire 2. Collect blood and urine samples 3. Centrifuge, separate and freeze the samples and deliver them to the laboratory 	<ol style="list-style-type: none"> 1. Fill-in the individual questionnaire 2. Record anthropometric measurements 3. Fill-in the physical examination questionnaire 4. Collect blood and urine samples 5. Centrifuge, separate and freeze the samples and deliver them to the laboratory 	

The physician had the responsibility to make the physical examination and to fill the physical examination form, while checking the blood and urine sample collection, preparation, and delivery procedures.

The laboratory technician centrifuged the samples collected in the field or in the health center, separated them into smaller units, and delivered them appropriate conditions. There is a workflow chart for TNHS 2010, displayed in Table 6.

Before starting the study, each clusters address information was investigated and the closest health care provider (health centers, community health centers, hospitals, etc.) was selected for each cluster. An environment suitable for centrifuge and the freezer to work properly was created at this location.

The study was planned to take place on two separate days. The first day entailed filling out the household and individual questionnaire, and taking the anthropometric measurements; the second day entailed physical examination and blood and urine sample collection.

On the first day, the participants were informed about the location, method, and time of physical examination and sample collection. They were informed about the need to be fasting for 7 hours prior, and that early morning visits would take place on two days. If the physical examination form and sample collection were completed at the pre-selected health

center, the interviewed individuals were invited to this center.

On the morning of the 2nd day, the household was visited for the second time; the physician completed the physical examination and the filled the physical examination form, and supervised the collection of blood and urine sample collection. Because the blood and urine samples had to be collected following a fasting period, the visit took place between 7 a.m. to 10 a.m. on the second day.

On the first-day visit, the household was informed about the aim and the nature of the study and their intent to participate was learnt. The household questionnaire was filled out at every household where they agreed to participate. Using the Kish Selection Tables, the individuals to participate (one 0-5 year-old and one 6 year-old, where possible) were selected. Each selected individual was administered the age-adjusted individual questionnaire (0-5 or 6-11 year-olds questionnaire), their anthropometric measurements were taken, and physical examination form was filled out.

After sample collection

After sampling, the centrifuge and freezing process had taken place at the predetermined health care center if transportation was possible within an hour, and the sample had been transported in accordance with the cold chain transportation guidelines.

TABLE 7: Sections of the '0-5,' '6-11,' and '≥12 year-olds' individual questionnaires, TNHS 2010.

Sections	Individual questionnaire		
	0-5 yrs of age	6-11 yrs of age	12+ yrs of age
Section 1A: Basic information on the respondent	√	√	√
Section 1B: 0-5 year-old child nutrition	√		
Section 2A: Food supplements	√	√	√
Section 2B: Smoking	√		
Section 3: Physical activity	√	√	√
Section 4: Nutritional habits	√	√	
Section 5: Food consumption during pregnancy and lactation	√		
Section 6: Food purchasing and frequency of food consumption	√		
Section 7: A retrospective 24-hours dietary recall	√	√	√
Section 8: Anthropometric measurements	√	√	√

If the sample could not be delivered to the predetermined health care center within 1-hour, centrifuge equipment was taken to the field with the team. The sample was centrifuged in the field and delivered to the health care center in accordance with the cold chain transportation guideline, where centrifuge, separation and freezing procedures took place.

Blood was drawn under physician supervision. An additional nurse among the interviewers was responsible for the blood drawn.

Depending on the conditions within the province, physical examination and blood drawn procedures were carried out at the closest health care center for each stratum.

Samples were obtained between 7 a.m. to 10 a.m., and procedures until delivery of the samples were completed within the cold chain transportation guidelines.

Procedures

- Sticking barcodes on the sample tubes of the blood drawn
- Centrifuging the samples
- Separation of samples
- Sticking barcodes on separated samples
- Barcode control: The same barcode should be on the Individual Laboratory Samples Form and on sample tubes
- Sample freezing
- Sample transmission to transportation centers
- Sample delivery

DATA FORMS

Three different questionnaires were administered in TNHS 2010:

1. Household questionnaire

2. Individual questionnaire

- 0-5 year-old individual questionnaire
- 6-11 year-old individual questionnaire
- 12 year-old individual questionnaire

3. Physical examination questionnaire

1. Household questionnaire

Household members were defined as individuals living at the visited household for a minimum of one month. The interviewer conducting the household interview collected name, gender, age, literacy and education level, marital status, and health insurance ownership information on each household member. These data were used to identify the socioeconomic characteristics of the population of Turkey and to evaluate the sample quality. The household questionnaire also included a section on the characteristics of the property of the household members resided in, to evaluate the household economic status, and two different sections on the general nutritional habits of the household. The household questionnaire was completed with input from one respondent. Additionally, the section on the general nutritional habits of the household includes questions to be asked the household member(s) responsible for food preparation within the household. The household member list, compiled during the household interview, was used to identify the respondent(s) for the individual questionnaire(s). The individual interviews were conducted after completing the household interview.

2. Individual questionnaire

Individual questionnaires were developed to collect data on the following topics:

TABLE 8: Classification and cut-off points of BMI (17).

Classification	BMI (kg/m ²)	
	Main intersection points	Modified intersection points
Underweight	<18.50	<18.50
Severe	<16.00	<16.00
Moderate	16.00-16.99	16.00-16.99
Slight	17.00-18.49	17.00-18.49
Normal	18.50-24.99	18.50-22.99 23.00-24.99
Overweight / slightly obese	≥25.00	≥25.00
Pre-obesity	25.00-29.99	25.00-27.49 27.50-29.99
Obese	≥30.00	≥30.00
First degree	30.00-34.99	30.00-32.49 32.50-34.99
Second degree	35.00-39.99	35.00-37.49 37.50-39.99
Third degree	≥45.00	≥45.00

– *Basic information on the respondent:* Respondents date of birth and age were recorded.

– *0-5 year-old child nutrition:* Data were collected on breastfeeding and complementary foods intake of children aged between 0-5 years.

– *Food supplements:* Data were collected on the food supplements used within the past week.

– *Smoking:* Questions on smoking behavior were asked to participants who were 15 years and over old. .

– *Physical activity:* The respondents were asked if they exercise and how much time they had spent for watching TV, videos, or DVDs on weekdays and weekends. Additionally, respondents aged 20 years and over were asked about the physical activities they perform throughout a day. Physical activities were recorded on the Physical Activity Recall Questionnaire, using the corresponding codes. Activities on the day prior to the interview date covering 24 hours, with 15 minutes intervals were recorded. The questions in this section were asked to identify the physical activity level of the individuals. The questions were asked to the individuals within the 2-5, 6-11, and 12 year-old age groups. In order to collect accurate data, the individuals responsible for the care taking of the 2-11 year-olds were interviewed. For the individuals aged 20 years, a 24-hour physical activity inventory was conducted. Afterwards, physical activity ratio (PAR) expressed as a multiple of basal metabolic rate (BMR) as multiplied for each activity and the energy (calories) spent

were calculated. Physical activity level (PAL) was calculated by dividing this value by duration of day in minutes, which is 1440. PAL values between 1.40-1.69 are classified as sedentary or light activity lifestyle; 1.70-1.99 as active or moderately active lifestyle; and 2.00-2.40 were classified as vigorous or vigorously active lifestyle (2).

– *Nutritional habits:* Questions were addressed to the respondents eating habits during meals and their snacking behaviors.

– *Food consumption during pregnancy and lactation:* Information regarding food consumption of pregnant and lactating women, 15 years of age, were assessed.

– *Food purchasing and frequency of food consumption:* Individuals of 15 years and over were questioned on the factors that the subjects paid attention while purchasing food. Also the subjects reported the intake of foods consumed during the previous month.

– *24-hour food recall questionnaire:* All respondents were asked to remember and report all the foods and beverages consumed in the previous 24 hours. All participants within the selected sample, over 2 years of age were interviewed for Retrospective 24-hour food recall questionnaire (3,4). All of the raw and cooked foods and beverages consumed within 24-hours as recipes for food mixtures or composite foods, foods or beverages in main meals and snacks were recorded in detail on brand, type and amount. The amount of food and water and/or beverages were recorded and

TABLE 9: Anthropometric measurements by age.

AGE GROUPS					
0-3 months	3 months – 2 yrs	2-5 yrs	6-11 yrs	12+ yrs	20+ yrs
Weight	Weight	Weight	Weight	Weight	Weight
Length	Length	Height	Height	Height	Height
-	Mid-upper arm circumference				
Head circumference	Head circumference	Head circumference	-	-	-
-	-	Waist circumference	Waist circumference	Waist circumference	Waist circumference
-	-	-	Hip circumference	Hip circumference	Hip circumference
-	-	-	-	-	Wrist circumference

calculated using the Photographic Catalogue of Food and Dishes: Portion Sizes and Amounts (5), as 'household measures' and 'mL/g.' Nutrients content of a portion or serving size of the foods and beverages consumed outside in restaurants, institutions, or others were recorded and calculated using a book on the Standard Recipes of Dishes for Food Service in Institutions (6).

For meals eaten at home, the person responsible for cooking was asked the type and amount of each food/ingredient added to the pot while cooking. After recording the 24-hour food recall of the individuals, the size and amount of the cooked food was estimated.

For the home cooked food, all the ingredients were recorded in household measures and quantity, and divided by the number of people sharing the food to determine the number of portions served. In order to accurately identify the portion sizes, Photographic Catalogue of Food and Dishes: Portion Sizes and Amounts was used (5). The amount of foods and beverages consumed were recorded and calculated as 'household measures' and 'mL/g.'. After the food and beverage amounts were calculated in grams, the energy and nutrients intakes were calculated using the BEBS-Nutritional Information System Software (7). The amount of energy and nutrients provided by these foods and the daily intakes of these nutrients were determined. Daily amount of food consumed (in grams) are grouped as follows:

1. *Meats*: Red meat, poultry, fish and processed fish products, sea foods, processed meat products (salami,

sucuk and pastrma-cured and dried meat, sausages, bacon, offals, etc.).

2. Eggs

3. Legumes, nuts / seeds, etc.

4. *Milk and dairy products*: milk, yogurt, cheese, diluted yogurt-ayran, kefir, ice cream, etc.

5. *Fresh vegetables and fruits*: green leafy vegetables, potatoes, vegetables, other fresh vegetables and citrus fruits, and other fresh fruits

6. *Breads*: whole wheat, whole grain, white bread, pita bread, naan, flatbread, phyllo dough, bagels, etc.

7. *Grains*: grain cereal (rice, rye, corn, wheat, etc.), flours (wheat, corn, rice, etc.), cracked wheat (bulgur), pasta, noodles, shredded wheat for dessert, breakfast cereals, cookies, crackers, cakes, fermented and dried flour and yogurt mixture- tarhana, starch, etc.

8. Water

9. *Non-alcoholic beverages*: tea (black, green), herbal tea, coffee, cocoa, soft drinks (cola drinks, soda, etc.), mineral water, fresh fruit/vegetable juice, ready-made fruit juice, sports drinks, energy drinks, traditional drinks, dried powder drinks, drink powders etc.

10. *Alcoholic beverages*: beer, wine, raki/arrack etc.

11. *Fats*: olive / nut oil, sunflower / corn / soybean oil, canola oil, hard margarine, soft margarine, butter / cream/ icing, tail fat / suet, etc.

12. *Sugars*: sugar, honey, jam, concentrated grape juice (molasses), other sugary foods (chocolate, peanut butter, etc.), pudding, Turkish delight, dried fruit pulp / churchkhela, tahini halva, confectionery, etc.

— *Anthropometric measurement questionnaire*: Anthropometric measurements were performed and recorded for each interviewed individual. Anthropometry is measurement of physical dimensions (height, weight, and circumferences, etc.) of individuals of different age, gender, and nutritional habits and determining their body composition (fat and muscle tissue). Anthropometric measurements are important in evaluating growth and as an indicator of muscle and fat tissue amounts and fat distribution across the body. Body weight, height, mid-upper arm circumference, head circumference, waist circumference, and hip circumference measurements are commonly used anthropometric methods. Anthropometry is an essential part of the assessment of the nutritional status of children and adults. Data on infants and children indicate the overall health status and adequacy of the diet. Over the years, it is a good indicator in reflecting the growth and development trends. In adults, anthropometric data is used to evaluate the health and nutritional status over lifetime, risk of diseases, and changes in body composition (8-10).

The anthropometric measurements of children aged 0-5 years

Body weight, height, head circumference, mid-upper arm circumference were measured and body mass index (BMI: body weight/height²; kg/m²) was calculated for children between 0-5 years of age. The data were evaluated based on gender, age group (0-3, 4-6, 7-12, 13-18, 19-24, 25-36, and 37-60 months), place of residence (urban/rural), and NUTS regions (12 regions). In evaluation of anthropometric measurements, "WHO-MGRS (Multicenter Growth Reference Study), 2006 and 2007 Growth Standards" developed for children between 0-5 years of age, were used (11,12). "The European Childhood Obesity Group", "International Pediatric Association", "UN Standing Committee on Nutrition", and "International Union of Nutrition Sciences" endorses WHO-MGRS 0-5 year-old growth curves in all nations (11-13). Currently, 125 nations adopted WHO growth curves (14). "Body weight for age", "length/height for age", "weight for length/height", "body mass index for age (BMI)", "head circumference for age (WC)", and "mid-upper arm circumference for age" indicators were used in determining the nutritional status. The data were evaluated using "WHO Anthro Plus" and "WHO Anthro Programs" (www.who.int/growthref/en/) (www.who.int/childgrowth/software/en/) (15). Measurements were interpreted based on the z-score (SD) cut-off points. According to these, distributions were

TABLE 10: List of laboratory parameters, methods, and sample types studied in TNHS 2010.

Parameters	Method	Sample type
1. Vitamin B1	HPLC	EDTA plasma
2. Vitamin B2	HPLC	EDTA plasma
3. Vitamin B6	HPLC	EDTA plasma
4. 25 OH Vitamin D	HPLC	EDTA plasma
5. Vitamin A	HPLC	EDTA plasma
6. Vitamin E	HPLC	EDTA plasma
7. Vitamin C	HPLC	Heparin precipitated plasma
8. Glucose	Photometric	SERUM
9. BUN	Photometric	SERUM
10. Uric acid	Photometric	SERUM
11. Creatinine	Photometric	SERUM
12. Total cholesterol	Photometric	SERUM
13. LDL cholesterol	Photometric	SERUM
14. HDL cholesterol	Photometric	SERUM
15. Triglyceride	Photometric	SERUM
16. Total Protein	Photometric	SERUM
17. Albumin	Photometric	SERUM
18. ALT	Photometric	SERUM
19. ALP	Photometric	SERUM
20. Iron	Photometric	SERUM
21. Iron binding capacity	Photometric	SERUM
22. Calcium	Photometric	SERUM
23. Phosphorus	Photometric	SERUM
24. Na	Photometric	SERUM
25. K	Photometric	SERUM
26. Microalbuminuria	Photometric	URINE
27. TSH	Immunoassay	SERUM
28. sT3	Immunoassay	SERUM
29. sT4	Immunoassay	SERUM
30. Anti-TPO	Immunoassay	SERUM
31. Anti-TG	Immunoassay	SERUM
32. PTH	Immunoassay	SERUM
33. Fasting insulin	Immunoassay	SERUM
34. Vitamin B12	Immunoassay	SERUM
35. Folic acid	Immunoassay	SERUM
36. Ferritin	Immunoassay	SERUM
37. Homocystein	Immunoassay	EDTA plasma / serum
38. Somatomedin C	Immunoassay	SERUM
39. HBsAg	Immunoassay	SERUM
40. Anti-HCV	Immunoassay	SERUM
41. Anti-HAV	Immunoassay	SERUM
42. Zinc	ICP MS	SERUM
43. Lead	ICP MS	SERUM
44. Selenium	ICP MS	SERUM
45. Copper	ICP MS	SERUM
46. Iodine (in urine)	ICP MS	URINE
47. Amino acids (n=26)	HPLC/LC-MS-MS and HPLC	Li heparin plasma
48. Fatty acids (n=18)	GC-MS	EDTA plasma
49. HEMOGRAM	18 parameters	EDTA total blood

obtained based on the following groupings: <-2SD: wasted/underweight/ stunted; -2SD-<-1SD:thin/short; -1SD-<+1SD: normal; +1SD-<+2SD: overweight/tall; and +2SD: obese/very tall (11-13,15,16).

Stunted (height for age), defines chronic nutritional deficiency. Among children displaying stunted growth, weight and height for age are below <-2SD, but weight for height is within the normal range.

Wasted (weight for height) defines acute or current, short term malnutrition. Wasted childrens weight by age and weight by height are below <-2SD, but their length/height for age is within the normal range.

Underweight (weight for age) defines acute and chronic or long-term malnutrition. Weight for age, length/height for age, and weight for length/height values are all below the normal range among underweight children (<-2SD).

Being overweight/Obese is defined by over the standard values or reference median values that are +2SD (z-score) for weight for height, weight for age, or BMI.

Overweight is defined by weight for height and weight for age, or BMI values over the standards or reference median values that are +1SD and <2SD (z-score).

The anthropometric measurements of children aged 6-18 years

Body weight, height, mid-upper arm circumference, and waist and hip circumferences were measured and body mass index (BMI: body weight in kg / height length-m²) was calculated for children between 6-18 years of age. The data were evaluated based on gender, age group (6-8, 9-11, 12-14, 15-18 years), place of residence (urban / rural), and NUTS regions (12 regions). In evaluation of anthropometric measurements, weight for age, height for age, BMI for age values along with "WHO AnthroPlus Software" and WHO reference values for children 5-19 years-2007 were used (15). Reference values include weight for age (5-10 year-olds), height for age (5-19 year-olds), and BMI for age (5-19 year-olds) values. Weight by age values are for until the age of 10 due to the variance during puberty. Measurements were classified and interpreted as <-2SD: wasted/underweight/ stunted; -2SD-<-1SD: wasted / short; -1SD-<+1SD: normal; +1SD-<+2SD: overweight/tall; and +2SD: obese/ verytall. Values of 4 pregnant and 17 lactating adolescents were excluded. The BMI (kg/m²) calculated using weight and height values, is an important indicator of obesity or being under weight (10, 17).

The anthropometric measurements of adults aged 19 years and over

For the adult age group (aged 19 or more), weight, height, mid-upper arm circumference, and waist and hip circumferences were measured and their BMI, waist/hip circumference and waist circumference/height ratios were calculated. The data were evaluated based on gender, age group (19-30, 31-50, 51-64, 65+, 19-64 and 19+ years), place of residence (urban / rural), and NUTS regions (12 regions). The arithmetic mean (\bar{x}) and the standard deviation (SD) values for each measurement were calculated. Additionally, their distributions were examined according to their cut-off points. The weight, height, mid-upper arm circumference, waist and hip circumference, BMI, waist/hip circumference and waist circumference/height ratios of adults (aged 19 or more) were evaluated based on gender, age, place of residence, and NUTS regions.

Body Mass Index: Evaluated based on the BMI cut-off points recommended by World Health Organization (WHO) (16,17).

Waist circumference: Waist circumference is an important indicator of abdominal obesity and the regional distribution of fat across the body; and is a risk factor for diet-related chronic diseases. WHO recommends waist circumferences < 94 cm for men and <80 cm for women. Waist circumferences between 94-102 cm among men and 80-88 cm among women are accepted to signal a necessity of taking precautions/disease risk, and 102 cm among men and 88 among women as indicators of high risk (18-20).

Waist Circumference / Height Ratio: Waist circumference/height ratios an evaluation method used for children over the age of 5, teenagers, and adults. The ratio constitutes risk if over 0.5 or under 0.4, and necessitates taking precautions. Values over 0.6 necessitate taking action and increased chronic diseases risk (21).

The anthropometric measurements of pregnant women

Maternal anthropometry is associated with a healthy pregnancy and a healthy birth weight for the baby. Height and weight of the pregnant women were measured and their pre-pregnancy weights were recorded based on self-reports. Pre- and during pregnancy BMI values were calculated. The data were evaluated based on age group (18-30 and >30 years), place of residence (urban/rural), NUTS regions (12 regions), and level of education.

The anthropometric measurements of lactating women

Height and weight of the lactating women were measured and BMI values were calculated. The data were evaluated based on age group (18-30 and >30 years), place of residence (urban/rural), NUTS regions (12 regions), and level of education. WHO reports that an approximately 4 kg of fat stored during pregnancy, though it can vary largely between individuals, is lost during lactation. Additionally, the weight loss is faster during the first 3 months, which slows down between months 4 to 6 and balances out; which is reported to be greater among women who only breastfeed their children for the first 6 months (16,22).

Tools used in anthropometric measurements

Body weight

0-2 years old children: Infant scale

2 years of age and over: Digital scales

Height

0-2 years: Infantometer (Recumbent height gauge)

2 years of age and over: Stadiometer (standing height gauge)

Circumference

Tape measure (rigid, but flexible)

Measurement Techniques of Anthropometric Measurements

All of the anthropometric measurements were held and evaluated according to recommended techniques and cut-off points (8, 9, 23, 24).

Measurement of Body Weight and Length/Height

INFANTS AND CHILDREN UNDER THE AGE OF 2 YEARS

- Recumbent length was measured, using an infantometer.
- Recumbent length of children who are shorter than 85 cm were measured.
- Body weight is measured lying down, using a infant scale.
- Mother/caregiver was informed about how the height and weight measurements would be made and their help/support was used.

CHILDREN AGED 2 YEARS AND OLDER AND 12 YEARS AND OLDER AGE GROUP

- Standing height was measured, using a stadiometer.
- Body weight was measured standing up using an adult scale.
- Weight measurements were taken in the morning

after fasting and defecation, when possible. However, due to lack of abiding by this rule in field studies, recording the end of the 24-hour Food Recall has been informative about the time of weight measurement.

When necessary weight of the clothing on individuals were subtracted from the total weight.

- The severely obese individuals who weighted more than the scale could weight, were recorded on the Individual Anthropometric Measurement Form as could not be measured. For the height and weight values of individuals who could not be or refused to be measured, their height and weight were recorded based on self-report.

- Measurements of individuals who are bedridden, unable to stand due to amputations of the leg, etc., and who have scoliosis or kyphosis were also performed and recorded but not evaluated.

- *HOWEVER, measurements were made on individuals with these problems as much as possible for reasons such as to avoid discrimination and isolation of these individuals from the society. The results were shared with the individual and recorded on the Individual Questionnaire with a side note to be cancelled afterwards.*

CALIBRATION OF WEIGHT AND HEIGHT MEASUREMENT TOOLS

- The scale was checked every day prior to the measurements using a constant weight or by the weight of the interviewer.
- The scale pointer was checked to point to 0.0 prior to each measurement.
- Height gauge was checked by measuring a constant length once a week.
- Precautions were taken when an error of more than 2 mm was observed.

MEASUREMENT OF BODY WEIGHT IN CHILDREN AGED 0-2 YEARS

- Infants were weighted naked. Otherwise, measurements were made wearing a thin clothing or a snap suit.
- Older children (aged 1-2) were measured wearing the least amount of clothing possible. They were undressed as much as possible without making the family uncomfortable.
- Diapers were removed during measurement. A diaper was put back on before measuring the height.
- The baby was covered in his/her blanket or clothing until weighted.
- A thin cloth was placed over the scale.

- The scale was considered ready once the pointer was at 0.0.

- The baby was placed on the scale, the measurement was made, and the measurement value was recorded.

Because the baby's inability to stay still and constant movement would lead to measurement errors, the staff waited until the pointer was back on 0.0. Then, first the mother/caregiver was weighted and their weights were recorded. Afterwards, the baby was placed in their arms and they were weighted together. The weight was recorded again the baby's weight was calculated by subtracting the first measurement from the second and recorded on the form. The staff helping the measurement staff has been helping during this process too.

- Measurements were made with 0.01 kg and 0.1 kg sensitivity.

MEASUREMENT OF BODY WEIGHT AMONG CHILDREN AGED 2-5 YEARS

- Mother/caregiver was asked to undress the child.

- The staffs attempted to comfort and calm the child down by talking, and mother/caregiver was asked to help as well.

- Waited until the scale pointer was at 0.0.

- The child was prepared for the measurement and weighted.

- If the child could not stand on the scale alone or was irritable and unable to stand, the staff waited until the pointer was back on 0.0. Then, first the mother/caregiver was weighted and their weights were recorded. Afterwards, the baby was placed in their arms and they were weighted together. The weight was recorded again the baby's weight was calculated by subtracting the first measurement from the second and recorded on the form.

- Measurements were made with 0.1 kg (100 g) sensitivity.

MEASUREMENT OF BODY WEIGHT AMONG INDIVIDUALS IN 6-11 YEARS AND 12 YEARS AND OLDER AGE GROUPS

- Thick clothing (coats, jackets, sweaters, etc.) was asked to be removed.

- Items in pockets (wallet, keychain, phone, address book, etc.), food among children, etc. were asked to be removed.

- The shoes were taken off.

- The feet were placed properly on the scale and it was made sure that the body weight was equally distributed between the two feet.

- The individual was asked to stand still and straight.

- Measurements were made with 0.1 kg (100 g) sensitivity.

MEASUREMENT OF HEIGHT AMONG CHILDREN AGED 0-2 YEARS

- The measurements were made by lying the baby/child down on the infantometer used.

- The length gauge was placed on a flat surface or a table.

- As if was carried out following the weight measurement, the shoes and socks were removed. The diapers removed before weight measurements were not put back on before height measurement.

- Hair clips, ribbons, hats, scarfs, etc. were removed.

- If the measurements were made in a cool place, the children were covered in blankets or another cover.

Mother/caregiver was asked to help.

- A thin cloth/soft paper was placed on the infantometer.

- Mother/caregiver laid the child down on the infantometer.

- With help from the helping staff/mother, the head of the child was placed against the fixed end of the infantometer by supporting it in-between his/her hands, stabilized, and the child's glance was made sure to be perpendicularly upwards (Frankfort plane: the lower limit of the ear canal must be aligned with the orbital-eye pit, and form a right angle with the infantometer).

- Eye contact and conversations were started to calm the child down.

- The measurement staff checks the position of the child and presses his/her left hand first on the child's knees and then on the ankles; and placed the sliding door against the child's heels with their right hand. While measuring the height of the newborn babies, minimum amount of pressure was placed and the baby's natural position was not forced to change much.

- If the child was extremely irritable and did not wish to extend both feet, a single foot was pressured down for measurement.

- The value was read on the tape measure on the infantometer and recorded by the assistant staff. Measurement value was rounded to the closest centimeter.

- The child was lifted from the infantometer.

- Measurements were made with 0.1 cm (1 mm) sensitivity

MEASUREMENT OF HEIGHT AMONG CHILDREN AGED 2 YEARS OR MORE AND ADULTS

- If the child was 2 or more years old, height measurement was made standing up.
- If the child was 2 or more years old, but the height was measured lying down because the child could not stand up, the value gathered was recorded after conversion to standing up measurement by subtracting 0.7 cm from measured height.
- If the child was 2 or more years old, and the height was measured standing up though irritable at the time, the value gathered was recorded after conversion to lying down measurement by adding 0.7 cm to measured height.
- Measurements were made to make sure the stadiometer was properly placed.
- Shoes and socks were taken off
- Hair clips, ribbons, hats, scarfs, etc. were removed.
- The child's feet were made sure to stay slightly apart with help from the mother/caregiver/assistant staff.
- Head, shoulders, back, hips, thighs, and heels touched the height gauge.
- The child kept calm and still.
- Assistant staff/mother helped the measurement staff to stabilize the head supporting the chin with thumbs and index fingers, and make sure the child stared right across, parallel to the ground. A Frankfort plane was established (the ear canal must be aligned with the orbital-eye pit, and be parallel to the floor).
- A slight pressure was applied to the child's stomach if needed to help stand straight.
- While keeping this position, the free hand was used to pull down the sliding bar and put the necessary pressure on hair.
- All of these procedures were completed as quickly as possible
- Measurements were made with 0.1 cm (1 mm) sensitivity

MEASUREMENT OF THE WAIST CIRCUMFERENCE

Waist circumference measurements were taken on individuals aged 2 or more.

The World Health Organization recommends the measurement techniques used in this study (18-20).

- Individual stands on flat grounds

- The tape measure does not stretch. Any tape that is not intact is replaced, and each tape measure is at least 150 cm long.

- Individual is asked to fast starting the night before measurement

- Individual is asked to wear thin clothing. Males pants and females pants/skirts were slid down. Anything that can interfere with the measurement, such as loose and thick clothing, belts, etc. was removed. Pockets were emptied.

- Individual was asked to stand straight with both hands and arms on the sides, feet close by (12-15 cm apart), and their weight distributed equally between two feet. Frankfort plane was established with the ear canal and the orbital-eye pit aligned and parallel to the floor.

- The person taking the measurement stood right across from the individual measured.

- The individual's lower right rib and the iliac bone spur on mid-axillary were located and marked.

- The distance between the two marks was measured and the midpoint between the two was marked.

- The individual was asked to breathe regularly, to exhale (not to hold breath), and not to strain him/herself during the measurement. Consequently, the abdomen was free and not contracted (breath was not hold).

- Circumference measurement was taken without loosening the tape measure or using too much pressure.

- Measurements were taken using the closest millimeter (with 0.1 cm sensitivity) and the values obtained were recorded. i.e.: 75.3, 88.1, 104.5 etc.

- The assistant staff, standing behind the measurement staff, made sure the tape was placed properly and parallel to the floor.

MEASUREMENT OF THE HIP CIRCUMFERENCE

- Individual stood straight with arms on the sides and feet aligned; and stared right across parallel to the floor (Frankfort plane: the ear canal was aligned with the orbital-eye pit and parallel to the floor).

- Measurement was taken by standing on the right side of the individual.

- The highest maximum point on the side of the hip was identified and the circumference measurement was taken with the tape measure. Tape measure was held parallel to the floor; which did the assistant staff ensure.

- The measurements were taken while individuals were wearing the thinnest clothing possible.
- Anything that could interfere with the measurement or lead to errors such as thick clothing, items in pockets that could thicken the pocket areas (keys, wallet, phones, address books, etc.), food or snacks in case of children were removed.
- Measurements were made with 0.1 cm sensitivity (19, 20).

MEASUREMENT OF THE MID-UPPER ARM CIRCUMFERENCE

- Measured in all age groups over 3 months and over (12, 24).
- The individual was dressed appropriately with short sleeves or the sleeves were taken off during measurement. Individual stood straight with arms on the sides with palms facing the upper thighs and feet slightly apart.
- A Frankfort plane was established (the ear canal must be aligned with the orbital-eye pit, and be parallel to the floor).
- Right arm was bent 90 degrees on the elbow and the palms were kept facing each other.
- Measurement staff stood behind the individual measured.
- The acromial process on shoulder scapula (lateral protrusion) was located and marked. Afterwards, the olecranon process of the ulna (inferior offset) was located. The midpoint between the two points was marked after the distance between the two was measured.

MEASUREMENT OF THE HEAD CIRCUMFERENCE (MUAC)

MUAC was measured among children aged 0-5 years (12, 24).

- Older children were measured while standing on their own
- Not stretching but flexible tape measure was used
- Hair clips and other accessories, hats, scarfs and other clothing were removed.
- Measurement staff was standing on the left side of the child.
- Point 0 on the tape measure was held on the lateral side of the child's head. The point on the eyebrows (supraorbital line) and the highest ledge behind the head (occipital protuberance) were measured with a tape measure passing over the maximum girth. The tape measure passed over the points above the ears

not over them. Slight pressure was applied especially if the hair was curly or fluffy.

- A Frankfort plane was established (the ear canal must be aligned with the orbital-eye pit, and be parallel to the floor).

- Measurements were made with 0.1 cm sensitivity.

MEASUREMENT OF THE WRIST CIRCUMFERENCE

- Measured in the 20 or more year-olds age group (24).
- Measurement was taken by standing across from the individual measured.
- Right arm was slightly bent from the elbow.
- Palm faced up and the hand muscles were loosened (not firm).
- The two styloid processes on the wrist (the distal ends of the radius and ulna bones) were located by thumbs and index fingers.
- Wrist circumference was measured using a tape measure above the styloid processes of the radius and ulna bones around the wrist line. The tape measure was held perpendicular to the forearm axis and along the same line with the front and back line of the wrist.
- Tape measure touched the skin but no pressure was put on the soft tissue.
- Measurements were made with 0.1 cm sensitivity (9, 24).

PHYSICAL EXAMINATION QUESTIONNAIRE

The first page of the form included information on the household, the individual to be examined and the physician who would do the examination. The following pages were the consent forms for "Children under the age of 18" and "Adults aged 18" or more.

The consent form was read by the doctor to the individual to be examined at a pace and in a tone that was comprehensible, and the individual was asked if there was anything that was not clear. Afterwards, the doctor filled out the blank sections on the "Participants / Patients Declaration" page that said "by Dr....." and

"I know that I can reach Dr..... at(work) or 05 (mobile) and at the Department / Health care center, and the participant filled out the personal information section that followed and signed the form.

Sections of the Physical Examination Form (23):

Section 1: Malnutrition related clinical signs and symptoms

observed in systems. Some of the statements on the form were explained below.

Plethoric face: red appearance, capillary vasodilation (erythema)

Conjunctival xerosis: dryness of conjunctiva

Bitot spots: Scleral symptoms looking like soapsuds

Xanthelasma: symmetrical yellow plaques on eyelids induced by lipid accumulation

Cheilosis: dry, chapped lips

Magenta tongue: purplish tongue

Xanthomas: Yellow plaques within the subcutaneous tissue, induced by lipid accumulation within the cells

Rosary: Expansion in shape of a linear sequence.

Section 2: The section where the physical examination findings were recorded. Physical examination was done in a private and quiet room where another person, of the same gender with the participant, was also present.

Vital Findings:

Blood pressure: Individual rested for five minutes before measuring the blood pressure: blood pressure measurements were made on the left arm.

Pulse: Individual rested for five minutes before measuring the pulse, which was measured on the radial artery for one minute.

Body temperature: Body temperature was measured from the underarms. Doctor placed the thermometer in the underarm area after making sure the area is dry, and evaluated the body temperature after three minutes.

Head - Neck Examination: Prior to the examination, neck and head of the individual were made visible (turtle necks, scarfs, head scarfs, etc. was asked to be removed). Thyroid glands were evaluated via inspection and palpation according to the World Health Organization criteria, and the size grade and nodule findings were recorded (25).

Thyroid examination: Grade 0: No Goiter
 Grade 1: Palpable goiter
 Grade 2: Visible goiter

Respiratory system examination: Thorax was made completely visible prior to the examination. During inspection, deformation, respiration rate and shape were evaluated.

Respiratory rate was measured for one minute. Afterwards, chest wall percussion and auscultation in the order listed. Any abnormal sounds heard during auscultation (rales, rhonchi) were recorded on the form.

Cardiovascular system examination: Cardiac apex beat and jugular venous distension were examined during inspection. Cardiac apex beat was inspected at the intersection of the 5th intercostal space and mid-clavicular line; the same location was checked using fingertip if it was not observed via inspection. If fingertip palpation failed as well, it was examined via the palm by turning the patient to left side.

Cardiac sounds were listened during auscultation. Any sounds other than S1-S2 (abnormal noises heard during systole [ejection sounds (clique), prolapse factions], pericarditis, abnormal noises heard during diastole: The third heart sound (S3) and fourth heart sound (S4), opening snap) or murmurs (systolic [early systolic, mid-systolic, pan-systolic (holosystolic), late systolic]) were recorded.

Abdomen: The abdomen was fully opened for inspection before the examination. The abdominal skin and the movements during respiration were observed during the inspection. Any abnormal structure or movement was reported.

The second step of the abdominal examination was auscultation, where the intestinal sounds were listened and those heard were recorded.

During palpation, hepatomegaly, splenomegaly, or any other enlarged organ was evaluated. In case of a detection of hepatomegaly and/or splenomegaly, the size was recorded in cm. If enlargement was observed in another organ than liver or spleen, its location was specified in the corresponding section.

In percussion, the whole abdominal area was evaluated; any abnormal sounds were recorded and liver, spleen, and costovertebral angle tenderness were evaluated.

Chronic Diseases: It was developed based on the World Health Organizations Global Burden of Disease list of diseases (26). The second part of this grouping includes chronic diseases. While surveying the chronic diseases, the individual was asked if they had a chronic disease diagnosed by a doctor and those not diagnosed by a doctor (specifically arthritis, rheumatoid, etc.) were disregarded.

Current medications: Medications were grouped based on ATC (anatomical therapeutic and chemical) system (27). ATC drug index is a method to form a medication list via classification. The ATC classification system classifies the medications in a stepwise approach based on the organs or systems they affect and their therapeutic, pharmacologic, and chemical properties. The study questionnaire used classification based only on the organ/system affected. Multiple answer choices were marked in this section.

Menstruation cycle: This section was applied to women aged 12 or more for surveying the menstruation cycle and regularity of it. The women were explained that they should count days starting from the first day of menstruation.

Section 3: Section including the questions on cancers that can be diagnosed early via screening programs. Cervical, breast, prostate, and colon cancer questions are included.

Section 4: Laboratory Parameters

DATA ENTRY

In TNHS 2010, the questionnaires completed in the field were checked prior to data entry. Afterwards, data were entered using the CSPro (Census and Survey Processing System) software package, on personal computers. Each questionnaire was double entered by different data entry clerks to ensure verification of all of the data retrieved from the field and the data entered. The 24-hour recall questionnaire was entered via Nutritional Information System BEBS 6.1 software (7), which was also double, entered to ensure verification.

STATISTICAL ANALYSIS

Error checks were done on the physical examination form data. During error checks, cross tabulations were used to identify and minimize inconsistent answers as in pregnant males, a 7-year-old with a miscarriage experience, etc. by going back to the questionnaire. The statistical analyses were conducted after the necessary corrections and data cleaning were completed. Unless stated, all statistical analyses were conducted using the weighted data set. Since it was not possible to work on some tabulations using the weighted data set (due to the n becoming a decimal number), statistical analyses for these tables were conducted using non-weighted data set by providing an explanatory note. A detailed report was prepared based on the main breakdown points such as gender, place of residence, age group, NUTS-1 region, and level of education.

Numbers and percentages were used to present the unclassified data such as prior chronic diseases. Median and inter-quartile range (IQR) values were used to present the evaluation results to avoid the deviations caused by outliers. To calculate the median, all values in the general and subgroup bases were listed in numerical order and the values in the middle were used as the median. After calculating the median, the quartile values dividing the same values into 4 equal parts were identified. The IQR was defined by subtracting the 1st quartile value from the 3rd one.

Necessary coding was done to make gender and/or age based classifications of evaluation values. To present the classified data created after coding, the numbers and percentages used as described above.

MS-Excel 2003 and Statistical Package for Social Sciences for Windows Version 15.0 (SPSS Inc., Chicago, ILL., USA) software packages were used to conduct statistical analyses and construct the tables.

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Birsan Alptekin	Dilek Berker	Ersin Nazlıcan	Filiz Kumlu Yıldırım	Halime Dağdeviren
Birsan Bulut	Dilek Kaynak	Ersin Saltık	Filiz Salış	Halit Baş
Buket Çelik	Dilek Kaynak	Ertan Atcı	Filiz Solcan	Halit Duruk
Burakhan Yiğit	Diyadin Bilici	Ertan İğci	Firdes Arslan	Halit Ergönül
Burcu Aydın	Döndü Akartürk	Ertan Murat	Fisun Er	Haluk Bülbüloğlu
Burcu Çiyanlı	Dt. Feridun İlday	Ertuğrul Çelikan	Funda Gez	Hamide Tortop
Burcu Çorak	Durdu Karasoy	Ertuğrul Sarıdağ	Funda Köseoğlu	Handan Altuncan
Burcu Kanak	Duygu Erçin	Esen Evrim Günay	Funda Süsleyen	Hanife Aycan
Burcu Tokdemir	Duygu Güven	Esin Keskin	Fusun Güzel	Hanife Çiğdem
Burçin Tekinel	Duygu Özcan	Esmâ Gürsoy	Fusun Işık	Hanife Şen
Burhan Genç	E. Deniz Akbulut	Esra Bürkük	Gamze Ayar	Hasan Erkurt
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Canan Bozbay	Eda Yılmaz Aydoğan	Fadim Karlılı	Gönül Demir	Hasan Satılmış
Canan Doğan	Edip Gürsel Erol	Fadime Korkmaz	Gönül Erden	Hasan Sayım
Canan Eriş Gebedek	Ekrem Hatipoğlu	Fadime Özbek	Görkem Kaya Ecdar	Hasibe Demirbağ
Canan Tarık	Elif Asal	Fadime Süllü	Gülay Bostancı	Hatice Altıntaş
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Hatice Esra Nişancı	İlknur Şentürk	Mehmet Ali Karaahmetli	Mualla Türel	Neslihan Özkan
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Hatice Korkmaz	İpek Birinci Görmen	Mehmet Dilek	Muhammet Rıza Açmalı	Nesrin Bostanoğlu
Hatice Öncel Çekim	İrem Değirmenci Tatar	Mehmet Ersoy	Muharrem Tural	Nesrin Demircier
Hatice Tanrıseven	İrşat Düzcan	Mehmet Gündoğdu	Muharrem Yahşi	Nesrin Şener
Hatice Yeniay	İshak Uyduran	Mehmet İ. Altan	Muhittin Gül	Neşe Çetin
Hatice Yılmaz	İsmail Aran	Mehmet İ. Altan	Muhittin Mortaş	Neşe Güven
Havva Arıcı	İsmail Bayındır	Mehmet Karataş	Mukaddes Dağ	Neşe Kaya
Havva Çatak	İsmail Kaptan	Mehmet Kaya	Mukaddes Miral	Neşe Yıldız
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Hayrettin Düşüktaş	İsrafil Doğan	Mehmet Özer	Murat Okay	Nezafettin Akbaş
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Türkyılmaz	M. Şefik Durgun	Mert Oray	Münire Işılak Demir	Nuray Yavaş
Hüseyin Bilgin	M. Ali Türkmən	Merve Birim	Mürre Koralp	Nuray Yıldız
Hüseyin Gökçe	M. Bülent Onuk	Merve Demirkol	Mürüvvet Elif Açikel	Nurcan Bardakçı
Hüseyin Güneş	M. Fevzi Atay	Merve İnce	Mürvet Kocabaş	Nurcan Duman
Hüseyin Kraca	M. Kamil Akça	Meryem Aydemir	Müslüm Açmaz	Nurcan Dursun
Hüseyin Şentürk	M. Meltem Kılıçoğlu	Meryem Çiçek	Müslüm Çerçi	Nurcan Eroğlu
Hüseyin Uzunkonak	M. Turan Teper	Meryem Genç	Müzeyyen Çalık	Nurcan Korkmaz
Hüseyin Zakir Barut	Mahizer Vural	Meryem Önal	N. Seda Demir	Nurcan Özgütçü Güleriyüz
İ. Emrah Deveci	Mahmut Akdağ	Mesut Akyol	N. Gülşah Özen	Nurettin Keklicek
İbrahim Durhan	Mahmut Akman	Mesut Ayhan	Nafiye Eker	Nurgül Yüksek
İbrahim Elhan	Mahmut Atçı	Mesut Gökçek	Nalan Gürsoy	Nuriye Akyüz
İbrahim Günay Keskin	Mahmut Çeri	Mesut Göztaş	Namık Delibaş	Nursel Koyuncu
İbrahim Makas	Mahmut Çiriş	Metin Bozkır	Nazan Sığınır	Nurşen Erdem
İbrahim Özdemir	Mahmut Karacık	Metin Kahraman	Nazenin M. Urhan	Nurşen Paşa
İbrahim Tepe	Mahmut Koç	Metin Karakuş	Nazigül Boztaş	Nurten Torun
İbrahim Topçu	Mahmut Şencan	Metin Uyanık	Nazmiye Demirel	Oğuz Aladağ
İbrahim Turna	Mahmut Tekin	Metin Yıldırımkaya	Necati Bayar	Oğuz Balcan
İdris Temiz	Maksude Köseer	Mevlûde Baş	Necati Karaca	Okan Özsoy
İlhami Bingöl	Maruf Yalçın	Mevlüt Maytalan	Necibe Yeşilyurt	Oktay Eraslan
İlhami İkinci	Maşide Bektaş	Mevlüt Yıldız	Nejla Tunç	Olca Özkan İnal
İlhan R. Turunçoğlu	Medine Dünya	Mihraban Tural	Nergül Şen	Onur Arabacı
İlkay Bucak	Mehmet Akköz	Mikail İpekler	Nesibe Andıran	Onur Oral
İlknur Çetinkaya	Mehmet Ali Duran	Mine Biçer	Neslihan Bukan	Onur Özlem Köse

Onur Ulkatan	S.Şule Özbay	Serpil Kalaycıoğlu	Şule Özsoyler	Yahya Tekin
Onur Yaslan	Saadet Orçan	Serpil Kızılcıoğlu	Şule Üçkardeş	Yahya Yetiz
Orhan Çelik	Sabri Medişoğlu	Serpil Kurnaz	Şükran Alpargın	Yakup Cemil Şahin
Orhan Demir	Sabriye Küçük	Serpil Ozkan	Şükran Ter	Yasemen Yalçın
Orhan Özcan	Sadık Kardeş	Serpil Şahbaz Polat	Şükrü Çaylak	Yasemin Çivi
Orhan Sırdaş	Safiye Çoban	Serpil Turan	Şükrü Ülker	Yasemin Demirdelen
Orhan Yıldız	Safiye Gülnar	Sertan Bulut	Tahir Dinler	Yasemin Deniz
Osman Demir	Safiye Kılıç	Sertap Kurban	Tahsin Akyüz	Yasemin Gökçe
Osman Demir	Safiye Şahin	Sevcan Güleş	Tamer Atlas	Yasemin Güven
Osman Ekinci	Sahibe Şimşek	Sevda Eren	Tayfun Şen	Yasemin Karagöz
Osman Nalbant	Sakine Çakmak	Sevda Ünlü	Taylan Ekinci	Yasemin Tuncer
Osman Özdemir	Salih Melendiz	Sevgi Bozkurt Körük	Tekin Akdere	Yaşar Albay
Oya Özsoy	Salih Tıgılı	Sevgi Can	Tekin Balcı	Yaşar Özkan
Ömer Adıgüzel	Saliha Demirhan	Sevil Çatak	Tekin Güler	Yavuz Gençay
Ömer Faruk Sekreter	Saliha Işık	Sevil Karahan	Telat Aydın	Yıldız Mersinlioğlu
Ömer Önal	Saniye Atabey	Sevilay Ünal	Teslime Özgüler	Yavuz Sanisoğlu
Ömer Ünsal	Sariye Bikirli	Sevim Gürbüz	Tuba Demir	Yeliz Ertoprak
Önder Balgün	Saynur Eribol	Sevinç Serttaş	Tuba Geleri	Yıldırım Demirci
Önder Demirelli	Sebahattin Yılmaz	Sevtap Yıldırım	Tuba Yılmaz	Yıldırım Çetin
Özcan Demirci	Seçkin Yücel	Seyhan Erdoğan	Tuğba Akinol	Yıldız Güneyler
Özcan erel	Seda Alasağ	Seyhan Zeren Şimşek	Tuğba Güneş	Yıldız Tunçkanat
Özden Duruhan	Seda Aras	Seyran Kılıç	Tuğba Kılıç	Yıldız Yavuz Barut
Özden İşler	Seda Gök	Sezai Kayalak	Tuğba Mançu	Yunus Kuyucu
Özden Ulutaş Alkan	Seda Tekay	Sezgin Açıl	Tuğba Üçüncü	Yurdagül Dündar
Özen Çavuşoğlu	Sedat Gülay	Sezgin Güleş	Tuğba Yalçın	Yurdagül Yürtcan
Özge Ekicioğlu	Sedat Karayıl	Sezin Sezer	Tuğrul Dereli	Yusuf Cerit
Özge Karaaslan	Sedat Kavas	Sibel Bumin	Tuncay Özer	Yusuf Çetin
Özge Ünlü	Sedat Topal	Sibel Dalkıran	Turan Şahiner	Yusuf Genç
Özgür Kara	Sefer Taşkın	Sibel Kopuz	Turan Turhan	Yücel Cihan
Özkan Aydemir	Seher Göver	Sibel Öztürk	Turgut Arpacı	Yüksel Koca
Özlem Atam	Seher Kutlu	Sibel Tural Aydemir	Turhan Tor	Yüksel Korkut
Özlem Demir Çakır	Seher Okur	Sinem Şahin	Tülay Altuğ	Yüksel Taşdemir
Özlem Düzensi	Selahattin Aydın	Songül Berçin	Tülay Ergeneçi	Yüksel Uluşen
Özlem Karakan	Selahattin Aydınli	Suat Çelik	Tülay Gün	Yüksel Yılmaz
Özlem Kunduracı	Selami Ordu	Subhi Gönc	Tülay Karamahmut	Z.Fusun Çavur
Özlem Örnek	Selcan Erdiñ	Sultan Dönmez	Tülay Kılıçkap	Zakin Albayrak
Özlem Pekşen	Selçuk Öztürk	Sultan Duru	Tülin Gürbüz	Zati Başköy
Öznur Karataş	Selda Akpınar	Sultan Gündoğdu	Türkan Batır	Zehra Aydın
Öznur Yapıcı	Selda Donduran	Sumur Gazezoğlu	Türkan Orhan Eryiğit	Zehra Aygül
Pelin Aktan	Selen Çakmakyapan	Suna Çiçek	Ufuk Bilsel	Zehra Dağ
Pembegül Çetinkaya	Selin Tunalı Çokluk	Sutay Yavuz	Ufuk Karderin	Zehra Doğan
Perihan Arslan	Selma Aksay	Suzan Öztürk	Uğur Aktürk	Zehra Nur Can
Perihan Gürpınar	Selma Kalkan	Süheyla Ergün	Uğur Demir	Zehra Özözen
Perihan Hekimoğlu	Selma Saraç	Süheyla Ergün	Utku Elmas	Zekeriya Dönmez
Pervin Kocaman	Selma Urhan	Süleyman Balcı	Uzm.Elif Yılmaz	Zeliha Aras
Pınar Akbudak	Sema Alkan	Süleyman Beyaz	Uzm.Fatih Önsüz	Zeliha Aslan
Pınar Akkuzu	Sema Kolukisa	Süleyman Yurdagül	Uzm.Gökhan Telatar	Zeliha Derman
Pınar Aydoğdu Arslan	Semanur Çimen	Sümeyra Sazlı	Uzm.Güledal Boztaş	Zerrin Kemerel
Pınar Diler	Semiha Eren	Sümeyye Keskin	Uzm.Ömer Balcı	Zeynel Abidin Yaren
Pınar Kasapoğulları	Semra Aras	Süveybe Akçe	Uzm.Serap Banak	Zeynep Büyükbaz
Rabia Duru	Semra Koçdemir	Süveyla Görmez	Ülkü Bastem	Zeynep Cihan Kara
Rafet Doğan	Semra Tahancı Diribaş	Şaban Bektaş	Ülkü Gül Cihan	Zeynep Çam
Rahime Ay	Semra Türkan	Şadiye Betül Uludağ	Ülkü Gündoğdu	Zeynep Çeliklelek
Rahiye Erdoğan	Sena Budak	Şaduman Kuru	Ülkü Yücel	Zeynep Erdem
Rahmiye Akman	Senem Yorulmaz	Şahin Bingöl	Ümit Hışır	Zeynep Erişkin Kaya
Raif Gülşehit	Seraceddin Çom	Şebnem Çakıroğlu	Ümit Korkmaz	Zeynep Gökçen Battal
Rakibe Aydın	Serap Albayrakoğlu	Şebnem Özgen Özkaya	Ümmü Demirci	Zeynep Nihal Işın
Ramazan Taş	Serap Kara	Şenay Kolaylı	Ümmühan	Zeynep Serinol
Rana Dakmaz	Serap Şen	Şengül Zaman	Kabasakaloğlu	Zeynep Zehra Coşkun
Raşit Ögüt	Serdar Hüseyin Kayhan	Şennur Tahmazoğlu	Ümmühan Çölgeçen	Zeynep Zengin
Recep Eğilmez	Serdar Ünal	Şenol Kahrman	Ümmühan Ejdar	Zikrullah Tüfekçi
Recep Eliaçık	Serkan Erçoban	Şenol Kurşun	Ümmühan Konak	Zöhre Altun
Recep Tepe	Serkan Fındık	Şenol Sariavcı	Ünal Barutçu	Zuhal Turkan
Reyhan Cengiz	Serkan Rüzgar	Şenol Şengül	Vahide İşliyen	Zübeyde Peker Uyar
Rukiye Gültaş	Serpil Atasayar	Şerife Atlı	Vahit Akça	Züleyha Kaplan
Rukiye Yılmaz	Serpil Aygün	Şerife Demir Ersoy	Vesile Ceyhan	
Ruşen Alınca	Serpil Bozot	Şerife Toplu	Volkan Özkaya	
S.Faruk Özyürek	Serpil Demiray	Şirin Aksoy	Yadigar Coşkun	