PART 4

Environmental and Social Determinants of Energy Balance-Related Behaviors

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Comparison of energy balance-related behaviors and measures of body composition between Turkish adolescents in Turkey and Turkish immigrant adolescents in the Netherlands

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Submitted

Abstract

Objective: To explore the influences of migration to a Western country on obesity and related risk factors by comparing measures of body composition and energy balance-related behaviors between Turkish adolescents in Turkey (TR-TR) and adolescents from Turkish immigrant ethnicity in the Netherlands (TR-NL).

Design: Cross-sectional survey or baseline intervention data from six Dutch school-based studies and one Turkish study.

Setting: Primary and secondary schools.

Subjects: A total of 915 (49% girls; 13.1 ±0.8 yr) TR-TR adolescents and 433 (51% girls; 11.7 ±1.3 yr) TR-NL adolescents were included. Outcome measures were self-reported sugar-containing beverages (SCB) consumption, fruit and vegetable (FV) intake, screen time (ST), physical activity (PA), measured body height and weight, body mass index (BMI), waist and hip circumferences, and skinfold thickness.

Results: Our data showed that more TR-NL adolescents were overweight (31% vs 26%) and obese (9% vs 6%) and had significantly higher mean BMI (21.1 vs 20.0 kg/m^2), waist circumference (72.2 vs 71.3cm) and suprailiac skinfold thickness (19.8 vs 13.1mm) than TR-TR adolescents. TR-NL adolescents reported significantly higher SCB consumption (1173 vs 115ml/d), less FV intake (295 vs. 647g/day), less ST (253 vs 467 min/d) and higher PA-levels (61 vs 27min/day) than TR-TR adolescents.

Conclusions: Immigrant adolescents in the Netherlands were more often overweight and had a less favorable dietary pattern than their peers in Turkey, while their PA and ST patterns were more favorable. These results suggest that adolescents from Turkish immigrant ethnicity in the Netherlands have adopted lifestyles towards the host culture.

Introduction

Overweight and obesity are major public health problems leading to an increased risk of non-communicable diseases (1). The prevalence of obesity and associated co-morbidities among children and adolescents has risen worldwide throughout the past three decades (2). It has been estimated that 10% of school children are overweight and a quarter of them are obese worldwide, whereas in Europe and America the prevalence is above 20% (3). Obese children are not only at risk for becoming obese adults (4), they are also more likely to suffer from psychosocial problems, lower academic achievement, and premature death (5,6).

The global rise in obesity prevalence, particularly in children, is too rapid to be explained by changes in genetic structure; therefore environmental factors are assumed to play an important role on development obesity risk behaviors (7). High availability of high-caloric food along with limited opportunities to be physically active, the so-called 'obesogenic environment' is typical for Western European societies and is likely to promote excessive weight gain (8).

It has been shown that Non-western immigrants living in Western societies are more often overweight and obese than Non-westerns who live in their country of origin (9). A recent study conducted among school children in Europe showed that immigrant adolescents are more often overweight than native adolescents (10). The Non-Western immigrant population (e.g., from Turkey, Morocco, Surinam, Antillean, Irak, Iran) form the majority of migrants in the Netherlands (11). Kleiser et al. (12) showed considerable differences in dietary habits between young persons coming from different origin living in the Netherlands. Previous studies showed that the overweight prevalence of Turkish children living in the Netherlands is high with gender differences (in boys 23%, in girls 30%) and that unfavourable energy balance-related behaviors (EBRBs), i.e., food intake, physical activity and sedentary behavior are common in this group (13-15). Participation in physical activities have a strong socio-economic status (SES) and ethnic gradient, with children from a low SES or from an ethnic minority being less likely to participate in regular PA than their more advantaged counterparts (16,17). Dutch children living in socioeconomically deprived areas seem to have the lowest levels of PA and the highest rates of overweight (18,19). Considering such a large Turkish immigrant population (i.e., 21% of the Non-Western immigrants), it is important to know their health behaviors and obesity and overweight patterns in order to reduce health inequalities. Exploring the potential influences of migration on weight status and related risk factors is possible by comparing immigrant adolescents to their peers living in Turkey. To the best of our knowledge, there is no study that compared weight status and related risk behaviors of Turkish immigrant adolescents and their non-migrant compatriots in Turkey. The current study aimed to compare the EBRBs, measures of body composition and prevalence of overweight/obesity between Turkish adolescents in Turkey and Turkish immigrant adolescents in the Netherlands.

Methods

In the current study we used cross-sectional data from one Turkish survey and six Dutch studies with data on weight status and EBRBs. All studies are compatible with regard to the study population, measures of body composition and assessed EBRBs.

Participants

For the Turkish data set, a total of 915 (49% girls) adolescents were randomly selected from healthy primary school children living in Ankara, Turkey. For the Dutch data, a total of 433 (51% girls) adolescents from primary and secondary schools from six different studies were included; i.e., the DOiT (n=32), DOiT AGAIN (n=38), ENDORSE (n=106), ENERGY (n=24), JUMP-in (n=158) and Pro-Children (n=75) (20-24). From these Dutch datasets adolescents with a Turkish ethnicity (i.e., at least one of the parents was born in Turkey) were selected for data analysis.

Participation of subjects in the different studies was voluntary and prior to acceptance, adolescents and their parents were informed about the objectives and methods of the studies and signed an informed consent form. The relevant ethical medical committees approved each study protocol.

Anthropometric measurements

Body weight (kg), body height (cm), waist and hip circumferences (cm), triceps, biceps, suprailiac and subscapular skinfold thickness (mm) were measured using standard measurement protocols. There were some differences with regard to the measurement techniques between included studies, e.g., measuring children's body weight with clothes (ENDORSE) or in underwear (JUMP-in, DOiT, DOiT AGAIN), repeating the measurements two times (ENERGY, DOiT), or having only one measurement (JUMP-in). Appendix 1 describes the detailed measurement techniques of each study.

Body mass index (BMI) was calculated as body weight (kg) divided by body height squared (m^2). Skinfold thickness measurements were summed. The definitions of overweight and obesity were based on age- and gender- specific BMI cut-off points for children and adolescents published by Cole et al. (25). Waist-to-hip ratio was calculated by dividing waist circumference by hip circumference.

Energy balance-related behaviors

Energy balance-related behaviors (EBRB) included in the current study were: soft drink and fruit juice consumption (ml/day), fruit and vegetable intake (g/day), breakfast frequency, daily physical activity (min) and screen time (min). Information on EBRBs was collected by self-report questionnaires in all studies. Table 1 shows the available data on EBRB per study. The specific questions used in each study are provided in Appendix 1.

Soft drink and fruit juice consumption

In Turkey and in the Dutch Pro-children study data on soft drink and fruit juice consumption was collected using a 24-hour dietary recall, i.e., amount of consumption on the day prior to the day of investigation. In the other studies data was collected by a food

frequency questionnaire recalling frequency of consumption per a usual week and the amount per day. Consumption of soft drink and fruit juice was summed to calculate total sugar-containing beverages (SCB) consumption. SCB consumption of more than 5000 ml/day was considered as unrealistic and excluded from further data analysis.

Fruit and vegetable intake

In Turkey and in the Dutch Pro-children study data on fruit and vegetable (FV) intake was collected using a 24-hour dietary recall, i.e., number of portions consumed on the day prior to the day of investigation.

Table 1. Available study variables by databases per country.

				TR-NL (n=433)			TR-TR (n=915)
	DOiT (n=32)	**DOiT AGAIN (n=38)**	**JUMP-in (n=158)**	**ENERGY (n=24)**	**Pro-Children (n=75)**	**ENDORSE (n=106)**	
Body weight	32	-	156	22	-	99	915
Body height	32	-	156	22	-	98	915
Waist circumference	32	-	156	22	-	99	508
Hip circumference	32	-	156	-	-	-	508
Skinfold thickness	31	-	-	-	-	-	508
TV watching	31	37	-	21	75	104	508
Computer use	30	37	-	22	72	105	508
Total physical activity	32	35	-	24	73	103	508
Soft drink consumption	20	36	-	23	-	97	915
Fruit juice consumption	26	36	-	24	75	-	915
Fruit intake	-	-	-	-	75	-	915
Vegetable intake	-	-	-	-	75	-	915
Breakfast consumption	-	37	-	23	-	15	915

Breakfast frequency

In both Turkey and the Netherlands, breakfast frequency per week was assessed. In the Netherlands breakfast consumption was assessed separately for week and weekend days. The variable was dichotomized as having breakfast everyday or not.

Physical activity (PA)

In Turkey, PA recalls for 3 consecutive days were taken. The average time spent walking per day was calculated by the recalls. In the Dutch data sets, time spent in PA was collected differently in different studies. The Pro-Children study recalled the duration of exercising in leisure time by one question, other studies assessed the frequency and time spent in active commuting to school, sports club activities and unorganized sport activities (DOiT, DOiT AGAIN, ENERGY), and in the ENDORSE the frequency and duration of sport activities involved in the past week were recalled (see Appendix 1).

Total screen time

Total screen time was calculated as sum of television viewing time and computer time and expressed in minutes per day. In both countries, the frequency (in a usual week) and duration of TV watching and computer use per day was recalled. In TR, ENDORSE, ENERGY, and DOiT AGAIN, playing electronic games was specifically mentioned in the question as an example of computer use.

Data analysis

All data analyses were carried out using SPSS version 15.0 software (SPSS Inc., Chicago, IL, USA). We applied pairwise comparisons according to gender and country using analysis of covariance (ANCOVA) to test group differences in EBRBs. In ANCOVA the differences between groups are tested adjusting for covariates. Differences between groups in categorical outcomes (overweight status, daily breakfast consumption) were tested with logistic regression analyses.

Differences between TR-TR and TR-NL adolescents were tested both in the total group and in boys and girls separately, due to earlier evidence on gender differences on weight status (13). Due to the variation in applied measurement methods in the different Dutch studies, we added a variable 'study cohort' as covariate in the ANCOVA models (when there are more than one Dutch study per outcome). Furthermore, age and body height (when waist circumference was an outcome) were added as covariates in the ANCOVA models, both in the total group and also in gender group analyses. Gender was added as a covariate in the total group analyses. The level of significance was set as $p< 0.05$.

Results

In total, 469 boys and 446 girls living in Turkey (TR-TR) aged between 11 to 14 years (mean: 13.1±0.8) and 211 boys and 222 girls with at least one parent born in Turkey living in the Netherlands (TR-NL) aged between 10 to 14 years (mean: 11.7±1.3 years old) were included. This age difference between the study samples was statistically significant (Table 2).

Measures of body composition and overweight/obesity prevalence

Mean age-adjusted body weight, BMI, waist circumference and suprailiac skinfold thickness were significantly higher in the TR-NL group than in the TR-TR group (Table 2), while the mean age-adjusted body height and hip circumference were significantly higher in the TR-TR group compared to the TR-NL group. Overweight and obesity were more prevalent in adolescents living in NL (31 and 9%, respectively) than in adolescents living in TR (26 and 6%, respectively) ($p<0.05$) (Table 2). Stratification by gender resulted in similar differences between the TR-TR and TR-NL groups, except that the difference in hip circumference and triceps skinfold thickness was smaller and not significant among girls, while differences in subscapular skinfold, sum of skinfolds, waist circumference, overweight and obesity were smaller and not significant in boys (Table 2).

Table 2. Gender and country specific mean (±SD) age and anthropometric characteristics of Dutch-Turkish (TR-NL) and Turkish-Turkish (TR-TR) adolescents.

	Boy				Girl				Total			
	TR-NL (n=211)		TR-TR (n=469)		TR-NL (n=222)		TR-TR (n=446)		TR-NL (n=433)		TR-TR (n=915)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Age (year)	11.7*	1.3	13.2	0.8	11.6*	1.2	13.0	0.8	11.7*	1.3	13.1	0.8
Body weight (kg)	48.9*	13.9	47.4	9.6	50.5*	12.6	46.6	8.4	49.7*	13.3	47.0	9.1
Body height (cm)	152.5*	10.7	154.4	8.8	152.8*	8.8	152.0	9.0	152.6*	9.8	153.2	9.0
BMI (kg/m^2)	20.7*	3.8	19.8	3.3	21.4*	4.0	20.2	3.7	21.1*	3.9	20.0	3.5
Overweight (%)	29		25		32*		26		31*		26	
Obese (%)	9		5		9*		7		9*		6	
Waist circumference (cm)	72.2	10.7	71.6	9.5	72.2*	9.8	71.0	8.8	72.2*	10.3	71.3	9.2
Hip circumference (cm)	80.2*	7.7	88.3	7.5	84.5	8.8	89.3	7.3	82.3*	8.5	88.7	7.4
WHR	0.86	0.05	0.81	0.06	0.82	0.05	0.79	0.06	0.84	0.05	0.80	0.06
Triceps skinfold (mm)	13.6*	5.1	17.3	6.6	18.1	7.4	18.2	6.4	15.5	6.5	17.7	6.5
Biceps skinfold (mm)	8.8	4.1	9.6	4.9	10.9	6.2	9.7	5.1	9.7	5.1	9.7	5.0
Subscapular skinfold (mm)	11.9	7.3	12.8	5.6	18.3*	13.2	13.8	5.5	14.5	10.5	13.2	5.6
Suprailiac skinfold (mm)	19.0*	11.3	12.9	6.6	21.1*	11.7	13.4	6.5	19.8*	11.3	13.1	6.6
Sumskinfolds (mm)	51.9	26.4	52.6	21.3	68.4*	37.4	55.1	20.8	59.2	32.3	53.7	21.1

* Significant difference between TR-NL and TR-TR group at $p<0.05$, WHR; Waist/hip ratio**,** Data analyses were adjusted for age (all except age) and cohort (all except skinfold measures; due to having one cohort per country for this outcome), height (only for waist circumference and WHR) and gender (only for the total group comparison)**.** ANCOVA and logistic regression was used for testing the differences between countries

Energy balance-related behaviors

Dietary behaviors

Daily average SCB consumption was approximately ten times higher in TR-NL than TR-TR adolescents (TR-NL:1173±769 ml/day, TR-TR: 115±211 ml/day) ($p<0.05$). The total FV intake was significantly higher in TR-TR than TR-NL adolescents (TR-TR: 647±409 g/day, TR-NL: 295±293 g/day). The proportion of adolescents reporting to eat breakfast daily was similar in both groups (TR-NL:52%; TR-TR:54%). Stratified analyses by gender yielded similar results, except the difference in fruit intake was smaller and not significant among boys (Table 3).

Physical activity

Table 3 shows the average PA levels. Total PA time was higher in the TR-NL than the TR-TR group (TR-NL:61±91 min/day, TR-TR:27±30 min/day) ($p<0.05$). Stratified analysis by gender gave similar results.

Screen Time

Total self-reported screen time was significantly lower in the TR-NL adolescents (253±167 min/day) compared to the TR-TR adolescents (467±123 min/day). Computer time was also significantly lower in TR-NL adolescents than TR-TR adolescents, whereas TV time was significantly higher in TR-NL adolescents (Table 3). Stratified analysis by gender yielded similar results, except the difference in TV time was not significant among boys.

Table 3. Energy balance-related behaviors of Dutch-Turkish (TR-NL) and Turkish-Turkish (TR-TR) adolescents, mean and SD unless otherwise stated.

	Boy				Girl				Total			
	TR-NL (n=211)		TR-TR (n=469)		TR-NL (n=222)		TR-TR (n=446)		TR-NL (n=433)		TR-TR (n=915)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
TV watching (min/day)	150.8	109.8	142.0	91.7	159.6*	121.1	123.5	86.7	155.3*	115.6	134.0	89.9
Computer use (min/day)	109.1*	89.6	315.0	148.7	89.6*	94.3	359.5	164.9	99.4*	92.3	334.3	157.4
Total screen time (min/day)	257.6*	160.0	454.9	116.0	248.5*	174.6	483.0	129.6	252.9*	167.3	467.1	122.8
Total PA (min/day)[a]	79.8*	102.8	29.2	30.2	43.1*	73.7	24.8	28.6	61.0*	90.8	27.3	29.6
Soft drink (ml/day)	858.3*	675.4	69.1	134.5	728.3*	596.3	96.2	166.9	790.3*	636.8	82.3	151.7
Fruit juice (ml/day)	458.9*	417.7	25.1	68.6	395.4*	366.2	41.0	96.0	425.8*	391.7	32.9	83.4
Total SCB (ml/day)	1210.8*	845.8	94.2	184.0	1140.9*	706.1	137.2	235.1	1173.1*	769.1	115.2	211.4
Fruit intake (g/day)	187.9	207.0	291.7	307.3	208.5*	243.6	360.6	330.1	199.2*	226.5	325.3	320.3
Vegetable intake (g/day)	99.7*	112.9	313.8	215.7	92.1*	106.1	329.7	214.7	95.5*	108.6	321.6	215.2
Total FV intake (g/day)	287.6*	252.8	605.5	391.5	300.6*	325.7	690.2	422.8	294.7*	293.0	646.8	409.0
Daily breakfast consumption[b] (%)	55		61		49		47		52		54	

a Walking, Biking, sports , b; Having breakfast everyday, SD: Standard deviation, PA: Physical activity, SCB: Sugar-containing beverages, FV: Fruit&vegetable,

* Significant difference between TR-NL and TR-TR group at $p<0.05$, Data analyses were adjusted for age (for all), cohort (except for fruit, vegetable and total FV intakes; due to having one cohort per country for these outcomes) and gender (only for the total group comparison).

Discussion

The present study examined differences in measures of body composition, overweight/obesity status, and a selection of EBRBs between Turkish adolescents living in Turkey and Turkish immigrant adolescents living in the Netherlands. Overweight and obesity rates were significantly higher among Turkish adolescents living in the Netherlands (TR-NL) compared to their peers living in Turkey (TR-TR). The TR-NL adolescents reported significantly higher SCB consumption and lower FV intakes. Furthermore, TR-NL adolescents reported higher PA levels but less screen time and computer use.

The mechanisms underlying the high prevalence of obesity are complex and multifactorial (26). Many immigrant groups of non-Western origin living in Western societies have high levels of overweight/obesity (18,27). The high rates of overweight and obesity among immigrant adolescents may reflect a response to their obesogenic environment; migrants' behavior is likely to be influenced by their socio-cultural and physical environment (28). On the one hand, the physical environment is likely to be the first element changing the behavior of immigrants, and changes in availability, and accessibility of facilities might influence participation in EBRBs (26). On the other hand, changes in the social and cultural norm also influence food intake and PA patterns of immigrants. Acculturation - the process of coherence to the host culture that occurs with migration - influences diet, PA and preferences of body size of immigrants (10). This acculturation can positively influence health and related behaviors. However, behavioral change of migrants is not always in a positive way, and not in the same direction for all behaviors (either healthy or less healthy changes) (9).

The act of immigration may also affect health, since it may be stressful with negative psychosocial impacts. These influences may explain our finding that Turkish immigrant adolescents in the Netherlands reported less favorable dietary habits, reflected in drinking significantly more SCB, and eating less FV compared to Turkish adolescents living in Turkey. A recent study including eight European countries showed that Dutch adolescents reported the highest quantities of soft drink consumption (29). Thus, Turkish immigrant adolescents in the Netherlands may be influenced by the social norm and peer modelling of consuming much SCB or the high availability of SCB in the Netherlands. Regarding the differences in FV intake, in Turkey, it is traditional in families to serve fruits after dinner. Among OECD (Organization for Economic Co-operation and Development) countries, numbers from Turkey indicate very high levels of FV consumption (30) and this may reflect the dietary habits of Turkish families living in Turkey. A recent study indicated that among Dutch children daily average FV intake was 224 gram in girls and 218 gram in boys (31). This shows that Turkish immigrant children reports higher FV intake than Dutch children but lower FV intake than Turkish children in Turkey.

Turkish adolescents living in the Netherlands reported significantly lower screen times. Among the TR-TR group computer time (average 334 min/d) was significantly higher than in TR-NL adolescents (average 99 min/d), while TV time (average 134 min/d in TR-TR) was significantly higher in TR-NL adolescents (average 155 min/d). Computer use in Turkey has become widespread especially after 1990's and continued to increase rapidly since the beginning of the 2010's (32). A recent study showed that most of the high-school

adolescents (67%) use Internet cafes to play computer games, chat, and surf the internet; boys prefer going to such places more than girls in Turkey (33). Gathering to play multi-player games in Internet cafes is way of socializing with friends and increases the computer time of Turkish children (34). Cultural and/or parental rules for watching TV as well as the accessibility of other competing/concurrent media like computers may influence the amount of time young people spend watching TV (35). Results of the ENERGY-study, suggest that non-native Dutch children spend more time in screen activities than natives (157 min/d in non-natives vs. 118 min/d in natives) (11). This indicates that Turkish immigrant children reports higher screen time than Dutch children but lower screen time than Turkish children in Turkey.

TR-TR adolescents reported significantly lower PA levels than TR-NL adolescents. A recent European study showed that Dutch adolescents are one of the most active in Europe, especially with regard to active transportation (29). Adolescents may learn from others by observing, thus social support and social network from friends/family and schools may influence being active (36). Turkish immigrant adolescents in the Netherlands might be influenced by the high social norm of active transportation from/to school and the active transportation facilities (e.g., separate bike lanes) in the Netherlands. However, Dutch adolescents from Turkish ethnicity are still less active than native Dutch adolescents (37).

Our results confirmed that dietary, PA and sedentary habits are influences by the physical environment and the social and cultural norms.

Strengths and limitations

This comparison study in a large sample on adolescents is unique. We had data from Turkish immigrant adolescents from several different cities in the Netherlands where the majority of the Turkish immigrant population lives, improving the generalizability of our findings. Furthermore, we had objectively measured anthropometric data. A weakness of the study is the different measurement instruments used especially with regard to the self-reported measures. Differences between countries might partly be explained by the assessment methods. The differences at total PA measurement methods may cause underestimation of total PA in some cohorts. Furthermore, EBRBs were assessed by self-report suffering from recall bias and social desirable answers. In addition, the differences in data collection period (e.g., DOiT in 2003, ENERGY in 2011) may have influenced the results.

Conclusion

In conclusion, Turkish immigrant adolescents in the Netherlands showed higher levels of overweight and distinct patterns of EBRBs. Their dietary patterns were less favorable than their peers living in Turkey while their PA and screen time was more favorable. These findings suggest that Turkish immigrant adolescents in the Netherlands have an orientation towards their host culture, influenced by the socio-cultural environment they live in. This might result from the process of acculturation and integration into the Dutch culture. To reduce disparities and health inequalities in the Netherlands, it is important to understand the social and physical environmental factors that contribute to overweight and obesity among immigrant adolescents.

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SUPPLEMENTARY FILES

Appendix 1. Methodology of data collection on measures of body composition and energy balance-related behaviors in each study.

	DOiT (n=32)	DOiT AGAIN (n=38)	JUMP-in (n=158)	ENERGY (n=24)	Pro-Children (n=75)	ENDORSE (n=106)	TR (n=915)
Body weight	- Measured with a calibrated electronic flat scale (SECA 888)	-	- Measured with a calibrated balance (Care 2 Move Medical, Marsden MS-230; Marsden, the weighing company, Henley-on-Thames, Oxfordshire, UK), with underwear and without shoes.	- Measured with a calibrated electronic floor scale (SECA 861), without shoes with light clothing. Two measurements were taken. If they differed more than 1%, a third measurement was taken.	-	- Measured with a calibrated electronic floor scale (SECA 888), without shoes and with clothes.	- Measured with a calibrated electronic floor scale (SECA 861), without shoes with light clothing.
Body height	- Measured with a portable stadiometer (SECA 225), without shoes	-	- Measured with a folding length yardstick with a pedestal (Care 2 Move Medical, Marsden MH-226; Marsden, the weighing company, Henley-on-Thames, Oxfordshire, UK), without shoes.	- Measured with a portable stadiometer (SECA Leicester), without shoes. Two measurements were taken. If they differed more than 1%, a third measurement was taken.	-	- Measured with a Seca 225 mobile height rod, without shoes.	- Measured with a portable stadiometer (SECA 225)
Waist and hip circumferences	- Measured with a flexible band (SECA 200). Two measurements were taken. If they differed more than 1%, a third measurement was taken.	-	- Waist and hip circumference were measured with a flexible band (Seca).	- Waist circumference was measured with circumferences measurement band (SECA 201), two measurements were taken. If they differed more than 1%, a third measurement was taken.	-	- Measured with a spring loaded measuring tape (SECA 200). It was measured twice, if they differed more than 1 cm, it was measured twice again.	Measured with a flexible band (SECA 200)
Skinfold thicknesses	- Measured with Harpenden skin fold caliper on the right side of the body. Two measurements were taken, if they differed more than 1 mm, a third measurement was taken.	-	-	-	-	-	- Measured with Harpenden skin fold caliper on the right side of the body. Two measurements were taken, if they differed more than 1 mm, a third measurement was taken.

TV watching (min/day)	- Frequency of watching TV/video per week - Duration of TV/video watching on a day that he/she watches TV (were separately asked for week and weekend days)	- Frequency of watching TV (including watching DVD) per week - Duration of TV watching on a day that he/she watches TV (were separately asked for week and weekend days)	-	Duration of watching TV in free time per day (was separately asked for week and weekend days)	Duration of watching TV in leisure time per day	- Frequency of watching TV per week - Duration of TV watching on a day that he/she watches TV	- Frequency of watching TV per week - Duration of TV watching on a day that he/she watches TV
Computer use (min/day)	- Frequency of computer use per week (except for homework) - Duration of computer use on a day that he/she uses computer (was separately asked for week and weekend days)	- Frequency of computer use for playing games and leisure activities per week - Duration of computer use for playing games and leisure activities on a day that he/she uses computer (was separately asked for week and weekend days)	-	Duration of playing computer games and using computer for leisure activities in free time per day (was separately asked for week and weekend days)	Duration of PC use in leisure time per day	- Frequency of computer use (including playing games) per week - Duration of computer use on a day that he/she uses computer	- Frequency of computer use (including playing games) per week - Duration of computer use on a day that he/she uses computer
Total physical activity (min/day)	- Frequency of walking and/or biking to school per week - Duration of walking and/or biking to school on a day that he/she does these activities - Naming the sports participated in a club or at school (max 4 sports) and unorganised sport activities (max 4 activity) with weekly frequency and the duration per session	- Frequency of walking and/or biking to school per week - Duration of walking and/or biking to school on a day that he/she does these activities - Naming the sports participated in a sport club (max 3 sports) and outside sport club with their weekly duration	-	- Frequency of walking and/or biking to school per week - Duration of walking and/or biking to school on a day that he/she does these activities - Naming the favorite sports (max 2) and duration of doing this sport per week	Duration of exercising in leisure time per day	- Naming the sports (max 3) that he/she performed last week and the frequency (per week) and the duration (per session) of doing this sport	Physical activity recall for 3 consecutive days- Average time spent walking per day
Soft drink consumption (ml/day)	**FFQ** - Frequency of soft drink consumption per week - Amount of soft drink consumption on a day that he/she drinks soft drink (were separately asked for week-weekend days)	**FFQ** - Frequency of soft drink consumption per week - Amount of soft drink consumption on a day that he/she drinks soft drink (were separately asked for week-weekend days)	**-**	**FFQ** - Frequency of fizzy drink and fruit squash consumption per week - Amount of fizzy drink and fruit squash on a day that he/she drinks soft drink	-	**FFQ** - Frequency of soft drink consumption per week - Amount of soft drink consumption on a day that he/she drinks soft drink	**24 h recall** Amount of soft drink consumed on the day prior to the day of investigation

Appendix 1 – cont.

	DOiT (n=32)	DOiT AGAIN (n=38)	JUMP-In (n=158)	ENERGY (n=24)	Pro-Children (n=75)	ENDORSE (n=106)	TR (n=915)
Fruit juice consumption (ml/day)	**FFQ** - Frequency of fruit juice (the packed and freshly blended) consumption per week - Amount of fruit juice (the packed and freshly blended) consumption on a day that he/she drinks fruit juice (were separately asked for week and weekend days)	**FFQ** - Frequency of fruit juice (the packed and freshly blended) consumption per week - Amount of fruit juice (the packed and freshly blended) consumption on a day that he/she drinks fruit juice (were separately asked for week and weekend days)	-	**FFQ** - Frequency of fruit juice (the packed and freshly blended) consumption per week - Amount of fruit juice (the packed and freshly blended) consumption on a day that he/she drinks fruit juice	**24 h recall** Amount of fruit juice consumed on the day prior to the day of investigation	-	**24 h recall** Amount of fruit juice consumed on the day prior to the day of investigation
Fruit intake (g/day)	-	-	-	-	**24 h recall** Number of portions consumed on the day prior to the day of investigation	-	**24 h recall** Number of portions consumed on the day prior to the day of investigation
Vegetable intake (g/day)	-	-	-	-	**24 h recall** Number of portions consumed on the day prior to the day of investigation	-	**24 h recall** Number of portions consumed on the day prior to the day of investigation
Breakfast consumption (%)	-	Frequency of daily breakfast consumption (was separately asked for week and weekend days)	-	Frequency of daily breakfast consumption (was separately asked for week and weekend days)	-	Frequency of daily breakfast consumption (was separately asked for week and weekend days)	Frequency of daily breakfast consumption

FFQ: Food frequency questionnaire