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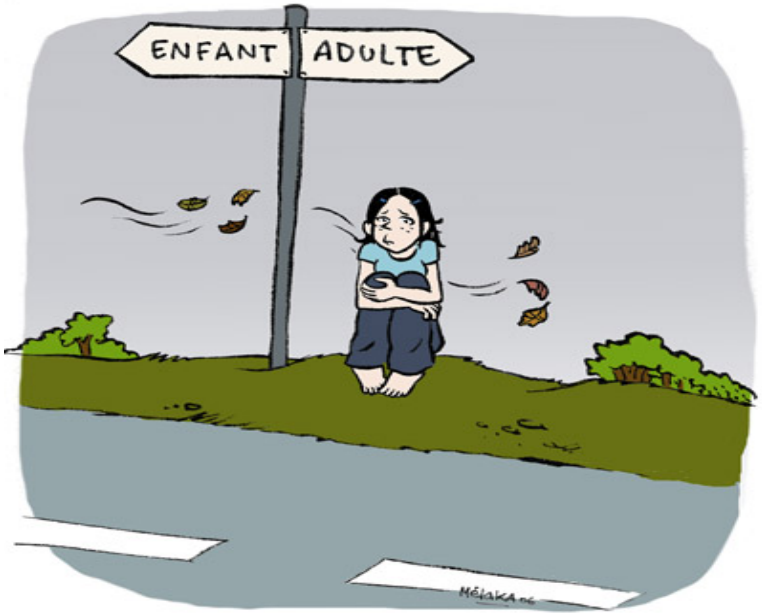
Assessment of general health findings with relation to blood lead levels in school children in Kırıkkale, Turkey

Prof. Dr. Selda Hızel Bülbül
Asoc.Prof. Dr. Cihat Şanlı
Asoc.Prof. Dr.Meryem Albayrak
Prof. Dr.Ülker Kocak

Kırıkkale University, School of Medicine, Department of Pediatrics

PUBERTY

- A dynamic process
- Period of rapid increase in height, weight, and muscle mass
- Secondary sexual characteristics and reproductive functions are developed
- Begin at 9-14 years in boys
  8-13 years in girls



Factors Affecting the health of Adolescent

- Inheritance
- Environment, climate
- Socioeconomic status
- Nutrition
- Common health conditions
- Chronic diseases
- Exercise

- For a proper targeting of adolescent care, information is needed on health status and lifestyles of adolescents and affecting external factors

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Place of Study

Kırıkkale, Turkey

- Kırıkkale is a province in the middle of Anatolia, with a population of 286.289
- Among all 19.5% (55.812) are 10 – 19 years of age
- There are only two services for the adolescents in the province at present

KIRIKKALE

- Is a place where lead contact is thought to be common
- There are industrial areas where lead is used as a raw material such as;
  - Military ammunition factory
  - Makine ve Kimya Endüstrisi Kurumu (Machine and Chemical Industry Corporation)
  - TÜPRAŞ (Turkish Petroleum Refineries Co.)

- In industrialized societies, environmental contamination caused by lead threatens the natural life and human health
- Children are more sensitive to chronic lead poisoning
- Even low blood concentrations can cause negative effects on children's mental and physical development
- Increased blood lead concentration due to environmental pollution could indirectly affect the timing of puberty through effects on growth

AİM OF THE STUDY

- To determine the blood lead levels in elementary school students in Kırıkkale province
- To show the general health status of adolescents with relation to serum levels of lead

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METHODOLOGY

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- Cross-sectional study

Study Group

- 905 students [451 male (49%) and 454 female (51%)]
- Mean Age 10.98 ± 2.2 years (min 7, max 15 years)

Place of Study

- 4 elementary schools within different distances to the weapons and brass factory of Machine and Chemical Industry Co.
- 2 schools close (500-1000 m.) to the factories
- 2 Schools far (5000 m.) from the factories

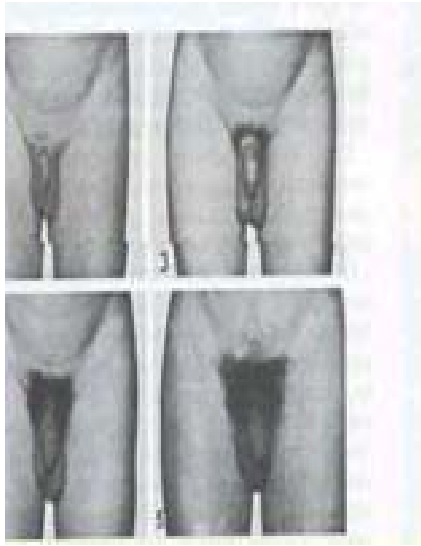
Questionnaire included;

- Parents' occupation and education
- Residence heating type
- Closeness to the street and/or the factory
- Drinking water used at home
- Number of people living at home
- Duration of playing outdoors
- Possible symptoms related to lead toxicity in children (stomachache, vomiting, constipation, headache, behavioral disorder)

- All children were passed through a general physical examination
- Anthropometric measurements were taken
- The growth status of the cases was determined by means of the growth curves developed for Turkish children by Neyzi *et al*
- Those children with body mass index (BMI) over 95th percentile according to their age were accepted as obese

- Breast development and the amount of pubic hair in girls, and testicular size and the amount of pubic hair in boys were recorded according to the Tanner staging system.
- If the secondary sexual characteristics are seen 2.5 SD years before the expected time, it was accepted as precocious puberty
- If they appear 2.5 SD years after the normal time, it was named as delayed puberty.

Tanner Staging System



- Blood pressures of relaxed children were measured between 9 - 12 am, three times for each child in a quiet room from the right arm and the arithmetic mean of the last two readings were recorded as systolic and diastolic blood pressures
- The 50th, 75th, 90th and 95th percentiles of the systolic and diastolic blood pressure values were calculated for male and female students in each age group.
- The ones, whose blood pressures were above 95th percentile with respect to age and sex were accepted as hypertensive, referring to the blood pressure percentile curves prepared by the United States Second Task Force Group (STF)

- Venous blood samples put in sterilized polypropylene tubes were kept in a deep freezer at –20 °C until the testing day
- Blood and serum samples were diluted with "Triton X"
- Blood lead was measured by Inductively Coupled Plasma Automic Emission Spectrometer (ICP-AES) in the Laboratories of Faculty of Agriculture, University of Selçuk, Konya

Statistical Analyses

- SPSS packet program of statistics was used
- Defining data were input as mean ± standard deviation
- Odds ratio, Fisher exact Ki-square tests were used
- Relation between puberty onset age and blood lead concentration were analyzed independent samples student's t-test and $p < 0.05$ was accepted as the significance level
- In evaluation of the relationship between the blood pressures and the factors like age, height, body weight, BMI, and surface area, Pearson correlation analysis was employed

Results

The average age was 10.98 ± 2.2 years (min 7, max 15 years)

Body weight percentile values of the study group

Age group	Body weight percentile							
	<%3		%3-97		>%97		Total	
	n	%	n	%	n	%	n	%
6-11 years	31	6.4	448	92.4	6	1.2	485	53.6
12 years,↑	42	10	369	87	9	3	420	46.4
Total	73	8.1	817	90.3	15	1.6	905	100

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Height percentile values of the study group

Age group	Height percentile							
	<3%		3-97%		>97%		Total	
	n	%	n	%	n	%	n	%
6-11 years	27	5.6	454	93.6	4	0.8	485	54
12 years,↑	35	8.4	377	89.5	8	2.1	420	46
Total	62	6.9	831	91.8	12	1.3	905	100

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Weight and Height Percentiles of the Study Group According to Sex

Sex	Height						Weight					
	< 3 %		3 – 97 %		>97 %		< 3 %		3 – 97 %		>97 %	
	n	%	n	%	n	%	n	%	n	%	n	%
Girls	27	6	421	93	6	1	57	12	388	86	9	2
Boys	35	8	410	90	6	2	16	3,5	429	95	6	1,5

Effects of demographic characteristics on growth

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Demographic characteristics		Growth retardation (+)		Growth retardation (-)		Total		
		N	%	n	%	n	%	p
Mothers education	8 years ↓	90	11	715	89	805	100	0.1
	8 years ↑	8	8	87	92	95	100	
Mothers occupation	Working	2	7	26	93	28	100	0.08
	Not working	96	11	776	89	872	100	
Fathers education	8 years ↓	62	10	516	90	578	100	0.15
	8 years ↑	36	11	286	89	322	100	
Fathers occupation	Working	93	10	755	90	848	100	0.9
	Not working	5	10	47	90	52	100	
Household size	5 ↓	62	9	586	91	648	100	0.06
	5 ↑	36	14	216	86	252	100	

The ages of breast development stages of the girls according to Tanner's staging, and their mean age, height and weight values

Breast Development	n	%	mean age (years)	mean height (cm)	mean weight (kg)
Stage 1	198	45.1	8.9 ± 1.4	128.9 ± 8.3	26.8 ± 6.0
Stage 2	43	9.8	11.4 ± 1.0	144.2 ± 7.4	36.3 ± 7.0
Stage 3	60	13.7	12.2 ± 1.2	149.6 ± 7.1	38.5 ± 7.3
Stage 4	49	11.2	12.9 ± 1.2	154.5 ± 7.1	45.5 ± 9.3
Stage 5	89	20.3	13.7 ± 0.8	158.4 ± 5.8	51.5 ± 9.4

The ages of testes development stages of the boys according to Tanner's staging, and their mean age, height and weight values.

Testes Development	n	%	mean age (years)	mean height (cm)	mean weight (kg)
Stage 1	299	65.5	9.9 ± 1.9	134.4±10.5	31.6 ± 7.9
Stage 2	79	17.9	12.5 ± 1.3	149.4 ± 8.9	41.0 ± 8.9
Stage 3	35	7.6	13.6 ± 0.9	155.9 ± 8.0	49.0 ±11.4
Stage 4	46	10	14.3 ± 0.9	163.9 ± 9.3	53.6 ±10.4
Stage 5	7	1.5	13.9 ± 0.7	166.1 ± 7.2	52.3 ± 7.8

Blood pressure

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Systolic hypertension:	40 (4.4 %) children
	2 boys, 28 girls
	1.8 % High SESs children
	2.5 % Low SESs children
Diastolic hypertension:	28 (3.1 %) children
	6 boys, 22 girls
	1.2 % High SESs children
	1.8 % Low SESs children
Systolic and diastolic hypertension:	15 (1.6 %) children
	4 boys, 11 girls

Blood lead levels of school children (mean ± SD)

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	n	Blood lead level (µg/dl)	p
All children	533	2.54 ± 1.44	–
Sex			
Girls	292	2.34 ± 1.39	p<0.001

	STAGE 1 n	STAGE 1 Pb (µg/dl)	STAGE 2, 3, 4, 5 n	STAGE 2, 3, 4, 5 Pb (µg/dl)	p
13-16 GIRLS	4	2.11 ± 1.37	83	1.60 ± 7.69	> 0.05
14-16 BOYS					> 0.05

No positive relationship was detected by the Pearson correlation test between both systolic and diastolic arterial blood pressure values and blood lead levels

SUMMARY

- The second decade of life is a period of rapid personal development
- In Turkey 41% of the population is consisted of 18 years of age or under
- Population of Kırıkkale is around 300.000 and 19.5% (55.812) is 10 – 19 years of age
- There are no sufficient services for adolescents and no sufficient data on the current situation of adolescents in Kırıkkale

- According to weight for age standarts 8% of the study group was under the 3rd pc
- 1.6% were over 97th pc
- According to height for age standarts 6.9% were under 3rd pc
- According to height for age standarts 6.9% were under the 3rd pc
- It was not different than the similar studies held in Turkey (4.1%- 8%)

- Mean age for stage 2 breast development in girls:

  11.4 ± 1.0 years

- Mean age for stage 2 testes development in boys:

  12.5 ± 1.3 years

- There were 4 girls and 2 boys with delayed puberty

- Systolic and diastolic hypertension ratios were 1.8% and 1.2% in children with higher socioeconomic levels
- The same values were turned out to be 2.5% and 1.8% in children with lower socioeconomic levels (p= 0.031)
- There was a positive relation between the arterial blood pressures (both systolic and diastolic) and the factors such as; age, body weight and height, for both genders

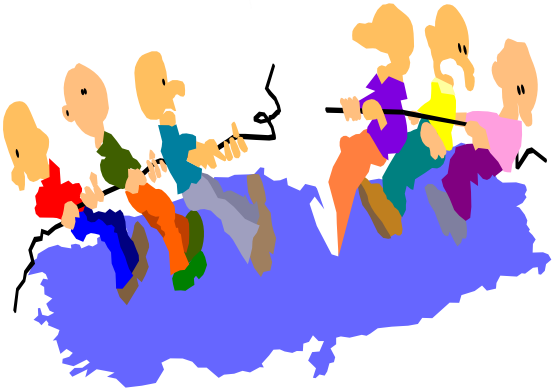
- Thirty eight children were found to be obese
- Four of them (10%) displayed both systolic and diastolic blood pressure elevations,
- It corresponds to a higher hypertension frequency than that of the whole group (7.5%)

LEAD IN CHILDREN

- Lead is a commonly found environmental toxic element that deteriorates health, especially that of ch
- Sixte es from rence of du tion
- Cent sed the t 30 µg/ 10 µg/dL in 1991

The normal blood lead level advised recently by World Health Organization is "0"

In Turkey….



- The mean blood lead level in 587 healthy children between the ages 2-16 years was

  3.67 ± 3.88 µgr/dl

  Kısmet E et all: Gülhane Tıp Dergisi 2004;46:33-37

- The blood lead level in 118 primary school students to be

  3.80 ± 2.07 µgr/dl

  Özmert E et all: Çocuk Sağlığı ve Hastalıkları Dergisi 2003;46:20-23

- Our study group's mean blood lead level was 2.54 ± 1.44 µgr/dl
- Its lower than both studies and also was lover
- dren
- BLL)
- BLL
- Every 1 µgr/dl increase in BLL decreases the IQ scores

  It is necessary to follow-up the children at risk periodically and monitor blood lead levels regularly in order to develop early prevention strategies against lead intoxication

Woolf et all, 2007, Pediatr Clin N Am

- Wu et al measured the blood lead levels of girls aged 6 to 16 years as 0.7 - 21.7 µg/dl; and stated that high lead levels cause delayed puberty

Wu T et all: Environ Healt Perspect 2003; 111(5): 737-741

- Although the lead levels are in normal range in the delayed puberty cases, it could be suspected an impact in the hypothalamus-hypophysis-testis pathway due to chronic lead exposure
- There might be a problem in LH production in the hypothalamus-hypophysis axis, possibly causing a direct testicular seminiferous tubular damage

Braunstein GD et all: Infertility 1978; 1(1) : 33-51.

- The blood lead levels in boys and girls with delayed puberty in our study group weren't different than other children with normal puberty development ($p > 0.05$)
- The adverse effects could be seen in long term period even in these levels, periodic controls of children under risk, regular surveillance of blood lead levels of children of parents working in factories where excessive lead contact is present and of children who live near industrial areas are needed
- This will, help to recognize the early effects of environmental lead contamination, which stands as an important risk for the health of the society, and precautions at individual and social level can be taken before the problem grows up

In consequences

- Adolescents come in all shapes and sizes being of different ages, sexes, cultures and life experiences
- Services for adolescents cannot be provided on the basis of 'one size fits all'
- Patterns of health problems differ between and within countries
- Community based studies are needed to see the main problems of the adolescents in the province for full fitting the needs

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This study gave us a great opportunity to achieve further improvements in quality of adolescent health care and let us to search ways how to integrate adolescents into our service delivery

ORGANİZASYON KOMİTESİ

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Prof. Dr. Olcay Neyzi

Kongre Onursal Kurulu
Prof. Dr. Ahmet Murat Çakmak
Prof. Dr. Gülbin Gökçay

Kongre Başkanı
Prof. Dr. Selda Hızel Bülbül

Kongre Düzenleme Kurulu
Doç. Dr. Didem Allefendioğlu
Yard. Doç. Dr. Tutku Soyer
Doç. Dr. Olcay Evliyaoğlu
Yard. Doç. Dr. Fulya Demirçeken
Doç. Dr. Gonca Yılmaz
Yard. Doç. Dr. Cihat Şanlı

Bilimsel Kurul
Prof. Dr. Ahmet Arvas
Doç. Dr. Adem Aydın
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Prof. Dr. Elif Özmert
Yard. Doç.Dr. Selda Polat
Doç. Dr. Figen Şahin
Prof. Dr. Betül Ulukol
Yard. Doç. Dr. Sevtap Velipaşaoğlu
Prof. Dr. Songul Yalçın
Prof. Dr. Kadriye Yurdakök
Uzm. Dr. Filiz Şimşek Orhan

İLETİŞİM BİLGİLERİ

Kırıkkale Üniversitesi Tıp Fakültesi
Çocuk Sağlığı ve Hastalıkları AD
KIRIKKALE - TÜRKİYE

Telefon : +90 318 225 2485 /2154
e-posta : seldabulbul@gmail.com
sfbulbul@yahoo.com

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