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The effect of labour on physical growth of children:Comparison of the results of two studies conducted in İzmit

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Summary

Aim: The study was carried out to determine the effect of labour on physical growth of children.

Material and Method: Data were derived from two different cross-sectional studies conducted on two representative samples of school children and of child workers in Apprenticeship School in İzmit. Children of similar age groups were taken from the data of both studies and 401 students and 243 child workers between the ages of 15,0 and 17,9 were compared. Some anthropometric indices such as z-scores of height for age, weight for age and body-mass index (BMI) were used to compare the working children and the students.

Results: When height and weight scores for each age group were compared, no difference was found between the working children and the students at 15 years old. However both indices were lower in the working children compared to the students at 16-17 years-old ($p<0.05$). On the other hand, BMI z-scores were not significantly different between the two groups.

Conclusions: In conclusion, both height and weight of the working children were effected negatively especially at older ages, the working children were shorter and more underweight compared to their non-working peers. However, BMI index which is frequently used in adolescence could not reveal the negative influence on the working children. *(Turk Arch Ped 2011; 46: 105-10)*

Key words: Anthropometric assessment, child workers, body mass index, height for age, weight for age, z-scores

Introduction

Child labour is still one of the socioeconomic problems which negatively influences children's health at the present time. According to the prediction of ILO (International Labour Organization) for 2004, a total of 317 million children in the age group of 5-17 years in the world are economically active. Most working children in the age group of 5-14 years live in Asia Pacific region and the highest rate of working children in the pediatric population is observed in Sub-Saharan Africa (1).

The United Nations Convention on the Rights of the Child defines a child as every human being below the age of 18 (2). International Labour Organization defines people below the age of 15 as "child workers" and names the ones between the ages of 18 and 24 years as "young workers" (3). When we examine the legal arrangements in Turkey, the public health law in Turkey forbids labor by children under the age of 12 (4). According to the labor law, it is forbidden to employ children under the age of 15, but children who have completed 14 years and have completed elementary education can be employed for light labors which will not interfere with physical, intellectual and moral development and which will not interfere with school attendence of the ones continuing their education (5).

Child labor is a complex problem in terms of both its causes and its consequences. Beyond the process of gaining a job traditionally or assisting the family in the rural areas, a process of transformation of children into workers is being experienced increasingly (6). Currently, poverty and unemployment of parents are the two important factors in child labor (7).

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Although child labor has diminished in years in Turkey, it still has substantial dimensions. According to Child Task Force Questionnaire performed in 2006, 5.9% of the population between the ages of 6 and 17 (958000) work in an economic employment. 556000 of these children are placed in the industrial, commercial and service sectors outside the agricultural sector. When we look at the share of child workers, we can see that it is 11% in 1994, 7% in 1999 and 4% in 2006 (8).

Similar to the adult workers, it has been reported that children working in the industrial area are exposed to various working place dangers, but they are affected to a higher degree compared to the adults (7,9). Physical and social conditions of child workers demage children's health in many ways. When evaluating the health state of child workers, growth and development criteria, feeding states, work accidents, psychosocial status and the incidences of diseases related to work should frequently be investigated (10).

Height for age (HFA) and weight for age (WFA) measures which are used widely to assess nutrition in childhood are frequently interpreted according to Z score system. According to this system, height for age below -1 is defined as short height and height for age below -2 is defined as short stature. Height for age which is a measure of a child's lineer growth is affected by chronic nutritional deficiency. Weight for age which is another measure is a combined measure affected by the height and weight of the child. Weigth for age below -2 means low weight. As used in our study, body mass index (BMI) for age is recommended to be used additionally to evaluate nutritional status during adolescence (11, 12).

This study was performed to demonstrate the effect of labor on the physical development of children by comparing some antropometric measures in child workers and students from the same age group.

Material and Method

The results of this study were obtained by reanalysis of the data obtained in two different studies performed in the same period. The first study is a cross-sectional study which performed antropometric evaluation of 2491 students representing students older than the fifth class (second section of elementary education and high school) dependent to National Education Directorate in the province of Kocaeli (13). Another study is a cross-sectional study which investigated growth and development in working children attending Occupational Education Center in Izmit (14). Both studies were performed during the education period of 2004-2005 and data about height and weight of the children were obtained with the same measurement devices and the same measurement technique.

In this study, only data of students living in Izmit from the first study were taken. To make a reliable comparison students between ages of 15.0 and 17.9 which is the age group where child workers are intensified were included in the study and younger students were excluded. Similarly, workers who were 18 years old or older were excluded from the second study. Consequently, in both studies, data belonging to 401 students and 243 child workers in the same age group were included in the study. After these arrangements were made, analyses were done by combining data.

In both studies, data including age, gender, height and weight which were common variables were compared. Height and weight measurements were obtained by SECA stadiometer. Weight measurement was performed with light clothes. Ages of the children were calculated by dates of birth. Antropometric measurements (HFA, WFA and BMI Z scores) were calculated using Epi Info 2000 program according to the standard population of CDC (Center of Disease Control and Prevention) (15). Afterwards, analyses were done by combining data using SPSS 11.0 package program. In analyses, the dependent variable was "child labor status", the compared variables were height for age Z score, weight for age Z score and BMI for age Z score. In addition, working conditions and characteristics of socioeconomic status for working children were given. Data of socioeconomic status were not available for the student group.

In statistical analyses, Student's t test (test for significance between the two mean values) was used if results of Pearson chi-square test and Kolmogorov-Smirnov test were compatible with the normal distribution and Mann-Whitney U test was used if results of these two test were not compatible with the normal distribution.

Table 1. Comparison of age and gender of the participants.

	Student n (%)	Child worker n (%)	Total n (%)	p value
Gender*				
Male	186 (46.4)	210 (86.4)	396 (61.5)	p< 0.000
Female	215 (53.6)	33 (13.6)	248 (38.5)	
Age*				
15.0-15.9	161 (40.1)	41 (16.9)	202 (31.4)	p< 0.000
16.0-16.9	163 (40.6)	86 (35.4)	49 (38.7)	
17.0-17.9	77 (19.2)	116 (47.7)	193 (30.0)	
Total	401	243	644	

* Pearson Chi-square test

Results

In our study, 161 of 401 non-working children whose data were examined (40.1%) were in the 15 year-old group, 163 (40.6%) were in the 16 year-old group, 77 (19.2%) were in the 17 year-old group. 41 of 243 working children (16,9) were in the 15 year-old group, 86 (35.4%) were in the 16 year-old group and 116 (47.7%) were in the 17 year-old group. It was noted that the two groups were different in terms of both gender and age. Male gender and older age were observed with a higher rate in child workers (Table 1).

When socioeconomic properties of the working children were examined, it was found that 85.7% had mothers with an education level of elementary school or lower and 67.8% had fathers with an education level of elementary school or lower. Families of 20% of the children had no social security. Mean household population was found to be 5.2±1.9. All girls were working as apprentices in hairdressers. 23.8% of the boys were working in hairdressers and the remaining were working as apprentices in repair, technical and mecanical sectors (24.3% automotive and 17.1% smoothing works). Half of the children (49.8%) had been working for 12 months or less, 27% had been working for 13-24 months and 22.1% had been working for more than 24 months. Daily working hours were markedly long ranging from 8,0 hours to 15,7 hours (mean value 11.3±2.0 hours). In addition, 53.1% reported that daily work continued until the work was completed and 35.8% reported that they worked in the night.

Table 2 shows the comparison of the antropometric measures. There was no difference between the working group and non-working group in terms of height for age and weight for age in the 15 years old age group. Mean value for height for age was -0.90 in the 16 year-old child workers and -0.26 in the students of the same age. In the 17 year-old group, the same values were found to be -0.85 and -0.41, respectively. The difference was found to be statistically significant (p<0.005). Graphic 1 shows that the median values of the working children in all three age groups are lower than the students, but this difference is significant for the 16 and 17 year-old age groups as noted abowe.

The mean values for weight for age was found to be -0.37 in the working children and -0.05 in the students in the 16-year-old group. The same values for the 17-year-old group were found to be -0.42 and -0.03, respectively (p<0.05) (Graphic 2). Statistically significant difference was not found in any age group in terms of BMI for age Z scores (Table 2).

No difference was found between the students and working children participating in the study in terms of obesity/ risk for obesity (Table 3).

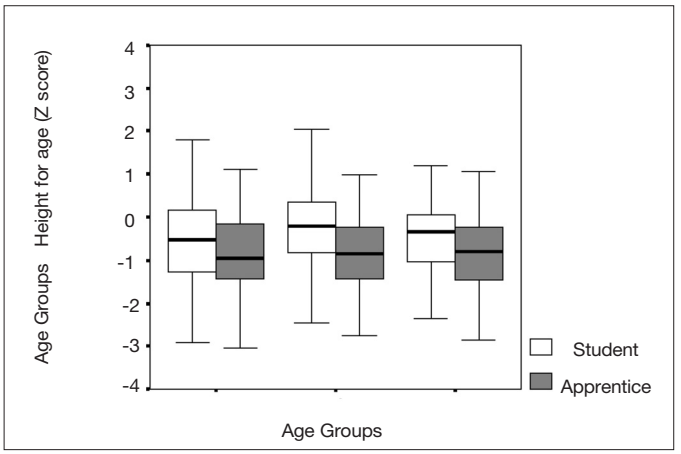
Table 2. Comparison of heigth for age, weight for age and body mass index for age Z scores in each age group

	Student		Child worker		
Age groups	**Median**	**Mean±SD**	**Median**	**Mean±SD**	**p**
Height for age (Z score)					
15.0-15.9	-0.54	-0.57±0.91	-0.95	-0.84±0.94	>0.05
16.0-16.9	-0.21	-0.26±0.97	-0.86	-0.90±0.94	0.000
17.0-17.9	-0.34	-0.41±0.94	-0.79	-0.85±0.81	0.001
Weight for age (Z score)					
15.0-15.9	-0.09	-0.02±1.00	-0.06	-0.11±0.67	>0.05
16.0-16.9	-0.01	-0.05±0.99	-0.36	-0.37±1.00	0.02
17.0-17.9	-0.04	-0.03±0.92	-0.42	-0.42±0.96	0.003
Body mass index for age (Z score)					
15.0-15.9	0.29	0.25 ± 1.02	0.26	0.28 ± 0.72	>0.05
16.0-16.9	0.02	0.02 ± 0.94	0.02	0.05 ± 0.88	>0.05
17.0-17.9	0.24	0.16 ± 0.90	0.08	-0.03 ± 0.90	>0.05

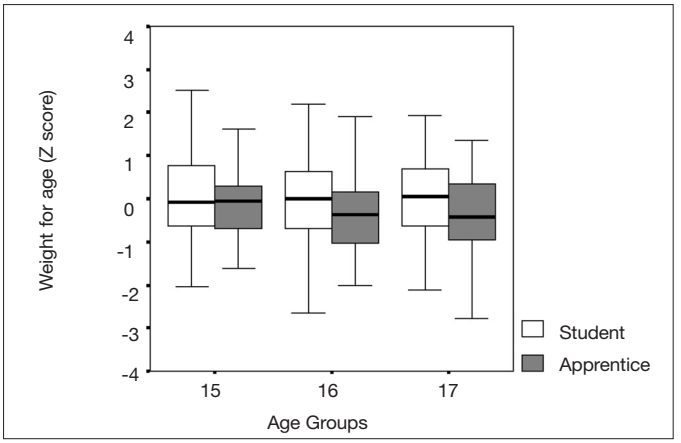
Table 3. Comparison of the risks of obesity in the participants.

BMI*	**Student n (%)**	**Child worker n (%)**	**Total n (%)**	**p value**
Below the 85th percentile	328 (81.8)	211 (86.8)	539 (87.7)	p>0.05
85th percentile and higher	73 (18.2)	31 (13.2)	105 (16.3)	

* Chi-square test



Graphic 1. Comparison of height for age Z scores in each age group



Graphic 2. Comparison of weight for age Z scores in each age group

Discussion

This study compares two adolescent groups of the same age group (one working and the other one non-working) in terms of antropometric measures. According to the results obtained in the study, height and weight of the working children were affected negatively, but the same effect was not observed for body mass index.

Since both researchs used in this study were performed cross-sectionally, they show the current status of the children. However, observational studies give more reliable and valuable results in evaluation of nutrition during childhood. One of the limitations of this study is that it is not an observational study.

According to the data of Kocaeli Regional Working Directorship, not all the working children in İzmit are registered in the center of occupational education. Therefore, the children who participated in this study do not represent all the working children in İzmit (16). The comperative student group is a sample group representing the students living in İzmit. Considering the facts that children who do not attend the apprenticeship school may be working in more negative conditions and children who do attend the apprenticeship school would be far away from the negative enviroment of the working place on the days they attend the school, the children in the first group are expected to have a more negative nutritional status than the other group. Therefore, exclusion of the apprentice children who did not participate in the research from the study might have led to more optimistic results.

On the other hand, distribution of age and gender is not similar in the two groups which were compared. However, this difference was not expected to effect the results of the research, because the three antropometric measures used in the research were calculated taking its own standard population as a source in each age and gender group (15). In addition, not being able to control various factors including genetics, diet, adolescence which may effect the difference in the antropometric measures was an important limitation of the study.

Labor effects the children's body directly or indirectly by various mechanisms and consequently working children are found to be more shorter and have a lower weight. Although the leading possible reason for this picture is nutritional problems, it should not be ignored that the musculoskeletal system is affected physically and the endocrine system is affected by chemical substances (9).

Since working children work in occupations which require physical activity, they consume more energy compared to the students. Despite this increased energy need, inadequate and inbalanced nutrition is in question (17). In the study performed in Ankara, it was found that only 1/5 of the apprentice children (21.4%) ate breakfast and again 1/5 (19,3) ate lunch with their own possibilities (18). However, the frequency of eating breakfast among high school students in the same age group was reported to be higher (54-80%), though not as high as desired (19-22). Thus, nutritional problems are observed widely in both the students and working children, but the problem is more prominent in the working children. The fact that irregular and inadequate nutritional conditions are observed more widely in the working children results in more frequent nutritional problems in the working children compared to the students. Studies performed in working children have demonstrated that labor effected height specifically and the height of the working children remained short, in parallel to our results (23-25).

On the other hand, it should not be ignored that economic poverty which was also the main reason for these children to work might have affected the fact that height and weight values for the working children were lower than the non-working children. Because of the design of this study, it was not possible to make analysis controlling the socioeconomic status. However, working children were found to have a lower socioeconomic level. In the whole of Turkey, 58% of women and 43% of men have an education level of elementary school or lower. In our study, the same rates for the mothers and fathers of the children who participated in the study were found to be 85.7% and 67.8%, respectively (26). On the other hand, household population in the whole of Turkey is 4.5, but the same number was 5.2 for the working children (27). When the fact that 1/5 of the families had no social security was added to this picture, it was shown that the working children analysed in our study were below the mean value of Turkey in terms of socioeconomic level.

Duyar and Özener (23) performed a study in two groups of children with a similar socioeconomic level (one working group and one non-working group). This study demonstrated the changes in the physical structure of children caused by labor independent of the socioeconomic level in detail. According to the results of this study, the working children were 1.5 kg lighter (at some ages 3.35 kg) and 3 cm shorter (at some ages 4.5 cm) compared to the non-working peers. In addition, body structure of working children shows a distorted development. Child workers have short height, short arms and legs, wide bones, big muscles and less adipose tissue. In the words of the investigators, such changes occuring in child workers are modal responses of the little bodies against the difficulties faced in the working life (23). In contrast, the observational study performed by Cortez et. al (28) found that child labor was related to the final height in adulthood and the difference of height disappeared when socioeconomic factors which were thought to be compounding were taken into account. In another study, it was reported that the height of working children was related to the working period independent of maternal age and economic income of the family (29). In our study, no difference was found in the 15-year-old group in terms of height and weight, but a difference was found in the 16-17-year old-group. This suggested that

the effect of labor developed with time. However, this difference may be caused by the lower socioeconomic level of working children compared to the average of Turkey. As a result, the facts that this study was not observational and could not be controlled for socioeconomic level were the limitations of our study.

Altough working children were in a more negative state in terms of height and weight, this negativity was not observed in terms of BMI. This is an important finding in terms of the method of studies about this area. Body mass index for age is the most commonly used method for assessment of nutrition during adolescence (30). Since body mass index is affected by height and weight, BMI's of these children whose heights and weights were lower compared to their peers were not found to be different. The finding of similar BMI's is a state masking nutritional problem in working children. In other words, assessment performed by BMI ignores the negative effect of labor on the child's body, can not determine the difference compared to the non-working children and classifies these children as normal.

In many work places where children work, physical enviroment conditions are rather negative. In addition to basic inadequacies including air condition, water and food hygiene, practices including narrow working place and strict dicipline rules which worsen working conditions may be exercised (17, p.124). The risk of being harmed in working children because of workplace hazards is higher compared to adults (9). The reasons for this may be explained by the fact that children are not aware of hazards and therefore can not protect themselves, as well as physical properties of children including a higher metabolic rate (24).

Another factor in the working enviroment which may affect the antropometric properties of children is exposure to chemical substances. It is known that children working in industry are under risk in terms of chemical substances including lead, mercury, isocyanates, etc. (9). In a study performed in 60 children who worked in automotive repair workplaces, lead levels were found to be higher in samples of both blood and hair (31). In addition, other factors which negatively affect children's health include absence of personal protective equipment, inadaquacy of personal protective equipment for children and determination of exposure limit values according to adults (24).

Another reason which affects growth and development in working children is the effect on musculoskeletal system mainly on the spine (17, p. 115). In addition to ergonomic problems, long working periods lengthen the time of exposure to this negative effect. In child labor questionnaires, mean weekly actual working period was found to be 37.4 hours in children working in economical works in the 6-17 year-old age group in the whole of Turkey. While the mean working period of children in urban regions is 51 hours, it is 30,5 hours in rural regions (8). In the study performed by Duyar and Özener (23), children were reported to work for 10,6 hours daily and 55% were reported to work more than 10 hours. Children working in industrial estates have been reported to work for long hours, work standing for long periods and receive very low salaries (32). In two studies performed in two apprenticeship schools in Ankara, working periods were reported to be approximately 6 days a week and 12 hours a day (18). In our study, the shortest working period of children was reported to be 8 hours extending up to 16 hours. Long and flexible periods of working cause physical exhaustion and many musculoskletal problems in these children who work as apprentices in industry. In a study performed in children who work in market place, it was reported that 28% had lower back pain, 21% had foot-leg pain and 9% had upper back pain (33). In a study performed in Brazil, musculoskletal diseases were found with a rate of 15% in child workers in the 10-17-year-old-group (34).

Conclusion

Labor is a factor affecting the physical development of children negatively. It has been found that height and weight of working children are affected negatively and working children have been found to be shorter and have a lower weight compared to non-working children. On the other hand, BMI which is used widely to assess nutrition during adolescence which is a period when labor is observed frequently can not determine nutritional problem in working children. To evaluate the use of BMI in terms of this aspect prospective studies monitoring growth and development in working and non-working children during adolescence should be performed. Beyond all this evaluations, prevention of child labor in the population and improving working conditions for children who have to work are considered as more basic solutions.

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