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# Secular changes in body weight and stature of male adolescent laborers

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## Abstract

It is well-known that there are positive secular changes in the growth patterns of children and adolescents in many parts of the world. In this study, an answer is sought to the question of whether there is the same trend in the growth of boys working as apprentices. For this purpose, body weight and stature values from two previous studies in Ankara, Turkey were reanalyzed, the first of which was conducted in the mid-1980s and the other in 2000 on children and adolescents working under similar conditions. Data from two studies shows that there is a positive secular change in the growth of apprentices over a 15-year time period. The secular gain is 1.1 kg/decade in body weight and 0.7 cm/decade in stature. This generational increase observed in apprentices is less than the gain seen in the general population at the same age, both in Turkey and in high-income countries of Europe and North America. These findings reveal that although there is some improvement in the living and health conditions of adolescents working as apprentices in Turkey, these conditions are still suboptimal.

## Introduction

Although the employment of children and adolescents who have not completed their physical and mental development is a phenomenon seen in almost every part of the world, the prevalence, extent, and characteristics of child labor may differ from society to society. For example, in some countries, children are predominantly employed in agriculture, while in others they are employed in the service sector or in small workshops. In addition, many tasks, such as helping with housekeeping, taking care of younger siblings, and herding animals, are among the routine tasks of children and adolescents. Although the employment of children is strictly prohibited even in high-income countries, it is known that the children of low-income families and immigrants are employed in many business lines, especially in the service sector, and even the slavery system continues widely (Bales, 2002).

When we look at the literature, there are many studies that mention that the employment of children negatively affects their health and physical development and even leads to pathological disturbances (Duyar, 2007). The origins of these studies date back to the times when the employment of children reached brutal proportions during the industrial revolution in the nineteenth century. Research from this period has demonstrated beyond dispute that the employment of children negatively affects health and physical development (see, for example, Engels, 1974; Tanner, 1981; de Hertd, 1996).

In today's studies on child labor, we encounter some studies that argue that working and being exposed to physical load and stress do not adversely affect the physical development of children, partly due to the relative improvement of poor working conditions and partly due to methodological deficiencies and/or the ambiguity of concepts on child labor and its definitions. Duyar (2013) has focused in another paper in more detail on how the methodologies and analytical processes of these studies should be viewed with a critical perspective. This study, in a manner of speaking, is a continuation of the paper mentioned above. In the aforementioned paper, a study conducted on children and adolescents laboring in various small-scaled workplaces in Ankara, Turkey, revealed that working and mechanical stresses negatively affect physical growth and development, and therefore a deformed and stunted physical structure develops in children and adolescents working as apprentices.

In the present paper, taking into account the studies on child labor conducted in Turkey, an answer will be sought to the question of how and in what way working children are affected by working conditions. Since these studies were carried out on different dates, they also give us the opportunity to examine how the effects of child labor on physical growth have changed over time. Therefore, the changes in the growth patterns of working children and adolescents and their reflections will also be examined.

## Growth studies on laboring children in Turkey

Although children and adolescents are widely employed in various jobs and branches of work in Turkey, the issue of whether their physical growth and development is affected by working conditions has not attracted much attention from researchers until recently. In retrospect, it can be said that experts working in the fields of nutrition and dietetics were the first interested in this subject. For example, Yücecan (1979) examined the nutritional status and energy expenditure levels of construction workers in her associate professorship thesis submitted to Hacettepe University, Ankara, and evaluated the situations of 116 young workers aged 12 to 18 years, in addition to adult workers. In another study carried out around the same time, Özarslan (1981) analyzed the nutritional status of 100 apprentices (aged between 12-18 years) working in an industrial site in Antalya and found that 38% of the sample were behind

reference values in terms of body weight. Nutrition-based studies continued in the following years (e.g., Şekerci, 1994; Bulduk et al., 2001).

Despite the fact that human auxological research has a history of more than a century in Turkey (Duyar and Erişen-Yazıcı, 1996; Duyar, 1998), studies on the growth and development of working children have only started to be carried out since the mid-1980s. The first studies on this subject, as mentioned above, were aimed at revealing the nutritional characteristics of working children, and studies on physical growth from an auxological perspective began much later. As far as is known, the first study on this subject was carried out by Gürhan Fişek (Fişek, 1986). In this study, he examined the health status and social problems of a total of 379 laboring adolescents aged 14-18 years in three cities (Ankara, Eskişehir, Bursa) and one middle-scaled town (Kızılcahamam) in inner Anatolia.

The number of studies dealing with the physical development of laboring children and adolescents began to increase towards the end of the 1990s. For example, Fırat (1998) focused on the growth status of boys and girls laboring in workplaces and factories in Yeni Bosna, Istanbul. The study is based on the comparison of 182 laboring adolescents aged 12-15 years with 170 schoolchildren in the same age range. Another similar study was conducted by Polat and Köseli (1999) on children and adolescents attending an apprenticeship training center in Denizli, western Anatolia. In this study, in which a total of 129 apprentices were examined, the stature and body weight values were compared with the reference values, and it was determined that 31.7% of the laboring children were in growth retardation in terms of stature and 47.2% in terms of body weight.

The most extensive research on the physical development of working/laboring children and adolescents was carried out on 532 apprentices aged 14-18 years old working in the workshops in Ostim and İskitler, Ankara, between 1999 and 2002 (Duyar, 2002). As a result of this study, in which 451 schoolchildren of the same age and with similar socioeconomic status and living conditions were used as the control group, it was clearly observed that the children and adolescents working as apprentices lag behind their peers attending school in terms of the main growth parameters of stature and body weight. Research data also revealed that while perpendicular (long bones and stature) growth is restricted in working children and adolescents, horizontal development (e.g., breadth measurements) accelerates, and thus working children enter into a change towards a shorter stature, short limbs, and stunted body type (Duyar and Özener, 2005; Duyar, 2008). Both the findings of this latest study and the results of other studies conducted in Turkey indisputably reveal that children who start working at an early age and are exposed to excessive physical loads have stunted and distorted bodies.

As can be seen, the last four studies about which information was given deal with the direct effects of physical loading and environmental stresses on human growth and development. By evaluating the findings of these studies, an answer can be found to the question of how and how much the physical development of working children is affected by working conditions. Moreover, by using the data obtained from Turkey, the question of whether the view that “work does not adversely affect the physical development of children,” which has been increasingly expressed lately (e.g., del Rosario and Bonga, 2000; Graitcer and Lerer, 2000; Cortez et al., 2007), is true or not, can be answered. Additionally, the question of how the working environment and conditions of apprentices have changed can be answered by examining whether the differences between the working and non-working groups have decreased in the time period between the two studies conducted by Fişek (1986) and Duyar (2008).

## Effects of working conditions on growth and development

Although physical growth and development can be examined in different ways, body weight and height are the two anthropometric variables most frequently preferred by researchers since they are the two variables that best reflect physical development. Other reasons for the widespread use of these measurements are that they are invasive, easily applicable, and cost-effective. As a matter of fact, in studies conducted in Turkey, it is seen that these two variables are generally used when evaluating the physical development of working children and adolescents.

When we look at the growth and development of laboring children in terms of body weight, the most examined anthropometric measurement, it is seen that children laboring as workers (or apprentices) in all studies are at a lower weight than their non-working (going to school) peers. For example, the average body weight difference between these two groups was found to be 1.59 kg in the study of Duyar (2008) and 3.3 kg in the study of Fırat (1998). Parallel to the findings of these two studies, the data of Fişek (1986) and Polat and Köseli (1999) indicate that working children and adolescents are underweight. All this data clearly reveals that working children show developmental delays in terms of body weight.

A table similar to body weight is encountered in stature, which reflects the total perpendicular development of the human body. In the four studies mentioned, it has been revealed that working children and adolescents are shorter than their non-working peers. For instance, Duyar (2008) found the stature difference between the two groups at 2.90 cm. Stature can be compared to a device that keeps a long-term record of the human body. If there is a lack of nutrition (undernutrition) or heavy working conditions for a long time (Yücecan, 1979), this leads to a short stature. In all the above studies, the fact that apprentices are shorter than their peers in terms of stature means that working children and adolescents are exposed to adverse conditions for a long time.

The fact that the physical growth and development of laboring children and adolescents lags behind their non-working peers in Turkey, which is one of the countries where the problem of child labor cannot be resolved, does not support the views that have been increasingly expressed in recent years, stating that working does not regress physical development. The factors underlying the increase in such opinions were discussed in another article with a critical approach, and it was emphasized that choosing robust children for working life might mislead researchers (Duyar, 2013).

In addition to these discussions, the concept of “work” should also be emphasized. If “working” requires a physical load that includes light bodily activities, then it is certain that it will contribute positively to the growth and development of the individual. However, when “work” is meant to be subjected to constant stress (for example, carrying heavy loads throughout the day or working in the supine position by getting under cars) beyond what the young bodies at their developmental age can handle, it can be easily stated that this will lead to the development of “deformed” bodies. Considering that working environments are generally stuffy, dark, dirty, and rusty in small repair shops, it can be easily predicted that children at this developmental age will be more affected by this.

## Secular trends in the physical development of working children

The second purpose of this paper is to reveal how the physical growth and development of working children and adolescence change over a long period of time. In order to achieve this aim, the research data of Fişek (1986) and Duyar (2002) were compared. There are several reasons for choosing these studies for the present analysis. The first is that both studies have larger samples than the others. The second and more important reason is that both studies

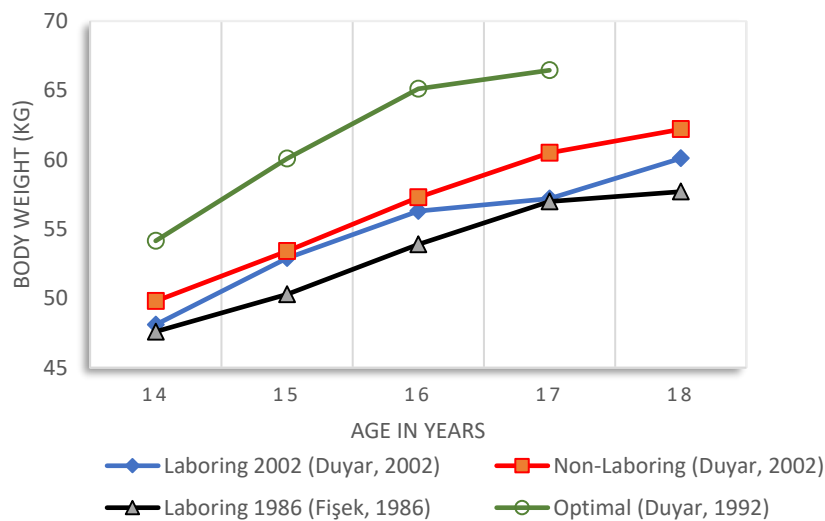
involve working children and adolescents living in Ankara. As it is known, in such comparisons, it is important to choose a sample from those living in the same or nearby places in order to track the secular changes. Although there were also apprentices living in Eskişehir and Bursa in Fişek's (1986) study, the fact that a significant part of the sample was living and laboring in Ankara makes the comparisons possible. If we remember that one of the other two studies was conducted in Istanbul (Fırat, 1998) and the other in Denizli (Polat and Köseli, 1999), it is understandable why the research data of Fişek (1986) and Duyar (2002) were chosen for the analysis.

The body weight and height values of the two studies selected for the comparison are presented in Table 1. There was an average 1.62 kg increase in the body weight of the male apprentices over a 15-year period. The increase is also observed in all examined age groups (i.e., in those aged 14-18 years). We can also clearly see from the growth curves that the physical development of working adolescents' changes over the examined time period. The data in the graph was obtained from three different studies. The first of these reflects the growth status of adolescents who come from the upper socioeconomic levels and represents the country's seven geographical regions (Duyar, 1992). The second data set is the findings obtained in the study of Fişek (1986), whose details are given above, on laboring children and adolescents. The third set of data is the growth values of the apprentices laboring in two manufacturing zones in Ankara, which is also mentioned above (Duyar, 2002). This last data set also includes the growth values of adolescents who have similar living conditions as apprentices but do not work, that is, attend school.

**Table 1.** Estimated differences in body weight (kg) and stature (cm) of laboring adolescents based on surveys in 1986 and 2001

Age group	Body weight (kg)			Stature (cm)		
	Fişek 1986	Duyar 2001	Difference	Fişek 1986	Duyar 2001	Difference
14	47.6	48.1	+0.5	155.4	158.4	+3.0
15	50.3	52.9	+2.6	160.8	163.1	+2.3
16	53.9	56.3	+2.4	162.1	165.9	+3.8
17	57.0	57.2	+0.2	168.3	168.0	-0.3
18	57.7	60.1	+2.4	169.1	169.0	-0.1

Looking at Fig. 1, the first thing that draws attention is that three of the four data sets, namely the growth curves of laboring adolescents, cluster together, while the adolescents in the upper socioeconomic status (SES) clearly diverge from the other three curves. As a result of this, it is clear that adolescents from the upper SES are significantly heavier than their laboring peers across all age groups, with the difference between the two groups typically exceeding 5 kilograms. These findings reveal that the physical growth of non-laboring adolescents living in relatively more advantageous conditions is significantly faster. On the other hand, it is seen that the working adolescents measured in Fişek's (1986) study have the lowest body weight values. Apprentices measured by Duyar (2008) are heavier than Fişek's (1986) sample. In other words, there has been an increase in the average body weight of working adolescents over the 15 years between these two studies.



**Figure 1.** Comparison of body weight values of laboring adolescents with those of non-working peers and adolescents from upper socioeconomic status.

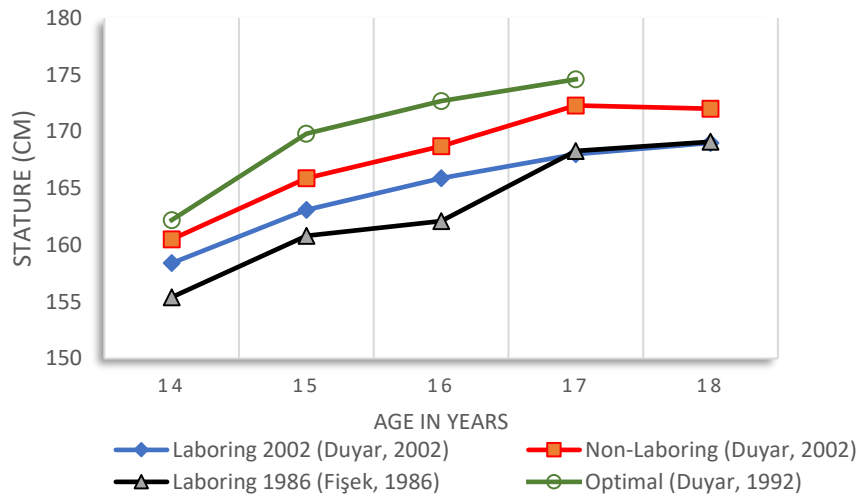
Based on data for Europe and North America, Tanner (1988) suggests the following rates of secular change between 1880 and 1950: 7.0 kg/decade in body weight and 2.5 cm/decade in stature for the adolescence period. If the rate of increase in body weight observed in male apprentices<sup>1</sup> in Turkey is calculated, it is seen that it is 1.1 kg/decade. This value reveals that the secular increase in apprentices lags behind the increase in body weight observed in high-income countries.

Two different interpretations can be made of this increase in the growth curve over time. The first is that the phenomenon defined as “secular change,” which has been encountered in many parts of the world in growth in recent centuries, is also in question among laboring children and adolescents in Turkey. The concept of secular change is used to describe the changes that occur between generations in human morphology and biological functions. For example, studies conducted in Northern European countries reveal that children tend to be taller and heavier than in the last two centuries (Tanner, 1988, 1990). The term “positive secular change” is used for these and similar changes, which manifest themselves in the form of enlargement and acceleration in growth in human morphology. A positive secular change trend has also started to be observed in Turkey since the last quarter of the twentieth century (Duyar, 1995, 2010). When the findings of studies on working children are compared, it is understood that apprentices tend to be heavier in parallel with this general trend in Turkey in the intervening 15 years.

Various views have been put forward to explain the causes of secular changes in human morphology and physiology. The first of these views emphasizes that the changes in question should be sought in the modifications that occur in the genetic structure or composition. However, it is common in the scientific community that secular change stems from the changes and improvements in environmental factors (van Wieringen, 1986). According to this second view, advances in health and hygiene—at least in some regions of the world—improvements in nutrition, living conditions, and working milieu cause people to be exposed to fewer environmental stresses, which in turn leads to differentiations in the human body and growth

<sup>1</sup> In Turkey, the majority of studies on working children have been conducted on boys. See Demir and Duyar (2021) for one of the few studies on girls.

rate. It seems to be a more reasonable approach to argue that improvements in working and living conditions play a role rather than the change in genetic structure, as well as the increase in body weight of working children over time.



**Figure 2.** Comparison of stature values of laboring adolescents with those of non-working peers and adolescents from upper socioeconomic status.

The secular trend in the stature of laboring adolescents is presented in Table 1 and Fig. 2. There was an average of 1.09 cm increase in the stature of apprentices in the time period studied. The rate of secular gain in stature is 0.7 cm/decade. This gain in apprentices is less than the increase seen in the general population, both in Turkey and in Europe and North America. While the secular gain rate in the early adolescence period is 0.96 cm/decade in Turkey (Duyar, 1995), it is 2.7 cm/decade for European and North American societies (Tanner, 1988).

When we look at growth curves in Fig. 2, we see that working children and adolescents are considerably shorter than both their non-working peers from low socioeconomic status and their peers from higher socioeconomic levels in terms of stature. When young people working as apprentices reach the age of 17, they are approximately 7-8 cm shorter than their upper socioeconomic peers and approximately 5 cm shorter than their non-working counterparts from lower socioeconomic status. This finding supports the view that laboring adolescents' working environments are negatively affected and, therefore, their growth is retarded considerably. Previous analyses revealed that laboring children's lag in stature is more obvious than their body weight (Duyar, 2002, 2013).

Returning to the question of what kind of secular change there has been in the stature of laboring adolescents in 15 years, it is understood that there is a clear positive secular trend in perpendicular growth as well as in body weight. In other words, today's laboring children and adolescents are taller than their counterparts in the past. The increase is more pronounced between the ages of 14-16 years, and there is no significant difference between the ages of 17-18 years.

The fact that there has been a slight increase in both body weight and stature in the last 15 years can be interpreted as some improvement in the working and living conditions of the apprentices. As a matter of fact, the findings we have obtained show parallels to the general trend of secular change observed in Turkey. Research on this subject reveals that there was no significant change in body dimensions until the mid-twentieth century and even the 1960s in



Turkey, and the change was observed after these dates (Duyar, 2010). The positive secular change observed in the body weight and stature of laboring children and adolescents is therefore in line with the trend observed across the country.

## Conclusion

One of the two questions sought to be answered in this paper is whether the physical development of children who enter working life at an early age and grow up with physical loads is affected by this. The reason why we have brought this question back to our agenda is that some studies conducted in recent years have found that working does not adversely affect children's physical growth and development. This question was attempted to be answered by considering the findings of previous studies in Turkey. In all of the studies conducted in this country, it has been concluded that the physical development of laboring children and adolescents is retarded. As a result, working children are adversely affected in terms of physical growth and development.

The second question sought to be answered in the article is whether secular changes occur in the physical development of laboring children and adolescents. For this purpose, the body weight and stature values of two studies conducted in Ankara, Turkey, at different times were compared, and it was determined that there was a slight positive secular change in the 15-year period. This finding is in parallel with the secular change seen in the general population in Turkey and means that there is some improvement in the living and working conditions of laboring children and adolescents.

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