European Journal of Education Studies
ISSN: 2501 - 1111
ISSN-L: 2501 - 1111
Available on-line at: www.oapub.org/edu

DOI: 10.46827/ejes.v102.4649 Volume 10 | Issue 2 | 2023

THE EFFECTS OF COVID-19 LOCKDOWN PROCESS: HEALTH STATUS OF YOUNG PEOPLE WITH AUTISM SPECTRUM DISORDER

Ebubekir Aksay[i]
Gelisim University,
School of Physical Education and Sport,
Department of Exercise and Sport in Disability,
Istanbul, Turkey
and
Germany TV Eberbach e.V.,
Department of Health,
Rehabilitation and Disability Sport,
Eberbach, Germany

Abstract:
It is believed that the COVID-19 pandemic, which has affected people worldwide, can negatively affect the health of young people diagnosed with Autism Spectrum Disorder (ASD). This study aims to investigate the changes in physical activity, time spent sitting, sleeping, and in front of screens, and food habits in young people diagnosed with ASD (n=76) during the two-week COVID-19 pandemic lockdown period in Germany. The Adapted Lifestyle Questionnaire was used to measure the changes before and after the lockdown. During the lockdown period, the frequency and duration of physical activity decreased, their time spent in front of screens, daily sitting and sleep times, consumption of foods such as carbohydrates increased, and consumption of fresh fruits, and vegetables decreased.

Keywords: autism spectrum disorder, COVID-19, physical activity, screen-time, sleep-time, consumption of foods

1. Introduction

Autism Spectrum Disorder (ASD) is considered a neurodevelopmental disorder characterized by a lack of social communication skills, sensory functioning difficulties, restrictive and repetitive behaviors, and verbal or nonverbal deficits (APA, 2013; Tarver et al., 2021a). The prevalence rate of ASD worldwide is estimated to be about 4%, but the diagnosed rate is estimated to be between 0.3–1.0% (APA, 2013). In 2004, one out of every

[i] Correspondence: email eaksay@yahoo.de, aksayeb@gmail.com

125 people was diagnosed with ASD (ASA, 2014), while new studies show that one out of every 54 children is diagnosed with ASD (Maenner et al., 2020).

As the incidence and diagnosis rate of ASD increases, there is also an increase in the interest in the health and development of these individuals (Aksay, 2021a). Although the symptoms of ASD vary from person to person, it is noted that children diagnosed with it often have disorders in cognitive skills (Tan & Pooley, 2016), language and communication skills, social skills, and social behavior (Aksay, 2022a; Lee & Vargo, 2017; Yarimkaya & Ilhan, 2020). Likewise, it is thought that motor limitations may be commonly seen in young people with ASD (Garcia et al., 2020) where anxiety and routine repetitions are seen to be high, regardless of the presence of a mental disability (Bhat et al., 2011; Liu et al., 2020).

A sedentary lifestyle has a negative effect on children and young people diagnosed with difficulties in communication, social, behavioral, and motor skills (Curtin & Anderson, 2010; Sisková et al., 2020; Srinivasan et al., 2014), but studies indicate that regular physical activities (PA) can positively affect motor performance (Aksay, 2022b; Aksay, 2022b; Aksay, 2021a), social interaction (Sowa & Meulenbroek, 2012; Yarimkaya & Ilhan, 2020), incompatible behaviors, stereotypical behaviors (Lang et al., 2010), sleeping patterns (Wachob & Lorenzi, 2015), and eating habits (Aksay, 2021).

The COVID-19 pandemic (Li et al., 2020) that emerged in 2019 has negatively affected many people regardless of their social status, economic situation, level of education, gender, race, faith, age, and nationality and has alienated them from active social life (Aksay, 2022b; Aksay, 2021a; Aksay 2021b; Andrieieva et al., 2022). While social contact restrictions, use of masks, body hygiene rules, and lockdown measures implemented during the pandemic have helped to prevent overloading of the healthcare system by reducing the risk of infection (WHO, 2020), however, the challenges posed by the pandemic have necessitated the elderly, adults, school-age children, and young people to stay at home for weeks, disrupting the routine lives of these individuals (Aksay, 2022b; Aksay 2021b; Chen et al., 2020). It is seen that this situation has affected everyone, more so young people diagnosed with ASD, especially during the lockdown period. Increased stay-at-home time, cooking more often, less physical activity (Jordan et al., 2020), excessive sleeping, more screen-time (Garcia, 2021), mental health issues (Brooks et al., 2020), improper nutrition (Shurack, 2020), and a sedentary lifestyle (Aksay 2021 a; Mattioli et al., 2020) are some examples of how the pandemic has impacted people's lives. With the emergence of mandatory stay-at-home regulations during the COVID-19 pandemic, the assessment of health-related behavior has become complicated. While the risks posed by COVID-19 on the health of individuals with normal development have been studied (Chen et al., 2020; Hongyan et al., 2020), it seems that studies examining the health-related behavior of young people with ASD during the COVID-19 are limited (Garcia et al., 2020; Wachob & Lorenzi, 2015).

In contrast to the previously conducted studies, it is important to examine if the periods of sitting, sleeping, and lying down and the physical activity of young people diagnosed with ASD are affected by the pandemic through a larger sample group. In

addition, there are no known studies in the literature investigating the effects of the COVID-19 pandemic on the food habits of young people with ASD. Consequently, it is hypothesized that the COVID-19 pandemic would negatively affect the participation of young people with ASD in physical activity, increase the time they spent sitting, sleeping, and in front of screens, and negatively affect their food habits. Thus, this study aimed to investigate these changes in young people with ASD during the COVID-19 pandemic lockdown.

2. Materials and Methods

2.1 The research groups

Participants consisted of 76 young people (63 males and 13 females), aged 14 to 17, who had been diagnosed with ASD (DSM 5 299.00) (APA, 2013) living in Germany. All participants were diagnosed with mild ASD, which was confirmed by the promotional card given to the participants by the local government. According to the psychiatric or medical diagnostic report, there were no mental disabilities and no restrictive secondary disabilities accompanying ASD. Young people who were too ill to answer questions themselves were not included in the study. This was determined based on the medical diagnosis report and the evaluation of the families.

The necessary approval was obtained from the TV Eberbach e.V. Department of Health Sports. Participation in the study was voluntary and in accordance with the Helsinki Declaration. Families were informed about the purposes, content, and data protection policy of the study, and signed consent forms were taken from the parents.

2.2 Procedure

Before the study, 18 schools and 6 rehabilitation sports clubs in the German State of Baden Württemberg where students with ASD studied, were contacted, and a preliminary information brochure was prepared through the school/club administration and sent to the families by e-mail. Feedback was received from 85 families and a 45-minute webinar was held with these families via Zoom to discuss the criteria for including participants in the study. After receiving the information, 9 families reported that their children would not be able to answer the questions on their own, and 76 individuals who could be involved in the study were identified. A 20-minute webinar was held again with 76 participants with ASD and their families, and the points to be considered when answering the questions were explained.

In March 2021, an electronic questionnaire consisting of questions about physical activity, time spent sitting or lying down (except for sleeping), time spent in front of screens, sleep, and eating/drinking habits was sent to the participants at the beginning of the week when the COVID-19 pandemic lockdown decision came into effect. The same survey questions were applied for the second time when the lockdown ended after about two weeks. Participants were asked to evaluate the entire two-week period spent during lockdown while answering questions.

2.3 Data collection tools

The families were asked to fill out a demographic information questionnaire consisting of four questions about the gender, age, height, and weight of the children. According to the information provided by the families, BMI values were calculated and converted into BMI percentiles. Percentile values interpretation and classification of BMI were determined using AGA reference values, which is the most common method for determining obesity in Germany (Wabitsch & Kunze, 2015).

According to BMI percentiles, three classifications were made: normal weight (<75%), overweight (75–90%), and obese (> 90%) (Wabitsch & Kunze, 2015).

The Adapted Lifestyle Questionnaire (ALQ) was used in the study to determine the changes before and after the COVID-19 pandemic full lockdown. UYTA was adapted by researchers from the International Physical Activity Questionnaire (IPAQ) (Booth et al., 1996), Recent Physical Activity Questionnaire (RPAQ) (Golubic et al., 2014), and Nutrition Survey under the German Health Interview and Examination Survey for Children and Adolescents (KIGGS) (Mensink & Burger, 2004). The adapted questionnaire form consisted of sections about physical activity, sleep, sitting/lying down time (except for sleep), time spent in front of screens, and eating/drinking habits.

Physical activity was assessed by the item "How many days a week do you participate in at least 45 minutes of physical activity?"

Sitting/lying down was evaluated by the item "How long do you spend sitting or lying down, except for sleeping, on a weekday/weekend?"

Sleep was evaluated by the item "How many hours do you sleep in one day on weekdays/weekends?" Since it was not possible to give exact sleep times, the estimated time period between the time the participant went to bed and the time he/she woke up was evaluated.

Time spent in front of screens was evaluated by the item "How many hours do you spend in front of screens on a weekday/weekend?" (Television, computer, tablet, phone, etc.) It was requested that the daily time of 45 minutes spent in front of screens for school activities before and after the pandemic should not be evaluated.

Eating habits were evaluated by the item "How many days a week do you consume the following foods?" (Fresh fruits, vegetables/salads, sausages/salami, pasta/noodles, french fries, honey/jam/nougat cream, chocolate/other confectionery, salty snacks such as chips, crackers, etc.)

Drinking habits were evaluated by the item "How many days a week do you consume the following beverages?" (milk, juices, lemonade/cola drinks) and "How many liters of water do you drink per day?"

2.4 Analysis of data

In the analysis of the data (IBM SPSS 26-for Mac), descriptive statistical analysis was used to identify the characteristics of the study group. To decide which tests (parametric/nonparametric) would be applied first in the analysis of the data, the assumptions that need to be required were tested. To determine the normality of the

distribution, Kolmogorov-Smirnov, kurtosis, and skewness values, as well as the histogram graph, which are other assumptions of the normal distribution, were used. Since the skewness-kurtosis values were in the range of ±2 (George & Mallery, 2010), the distribution of the data was considered normal. Paired Sample t-test and the Wilcoxon test were used to compare the two dependent groups. The significance level of 0.05 was used as a criterion in the interpretation of whether the obtained values were significant.

3. Results

Seventy-six young people diagnosed with ASD participated in the study. The participants' age (15.16±0.97 years), height (167.84±5.07 cm), weight (65.97±7.28 kg) and BMI (23.38±1.94 kg/m^2) averages, standard deviation, minimum and maximum values are shown in Table 1.

Table 1: Participant characteristics (n=76)

Variable	**n**	$\bar{X}$	**Sd**	**Min.**	**Max.**
Age (years)	76	15.16	0.97	14.00	17.00
Height (cm)	76	167.84	5.07	158.00	178.00
Weight (kg)	76	65.97	7.28	53.00	87.00
BMI (kg/m^2)	76	23.38	1.94	20.20	28.40
BMI: Body Mass Index					

Also, 82.9% of the participants were male and 17.1% were female (Table 2). According to the BMI percentiles, it is seen that 57.9% of the participants were of normal weight, 32.9% were overweight, and 9.2% were obese (Table 2).

Table 2: Percentage values of gender, normal weight, overweight and obese classification

Variables		**n**	**%**
Gender	Male	63	82.9
	Female	13	17.1
BMI Group	Normal weight	44	57.9
	Overweight	25	32.9
	Obese	7	9.2
BMI: Body Mass Index			

Table 3 shows the result of activity, sleep, sitting/lying down time, and screen-time variables pre-pandemic & during the pandemic. The participants reported engaging in a greater number of activities prior to the pandemic compared to during the pandemic. Participants reported that they participated in physical activities such as cycling, walking, jogging, swimming, mountaineering, tennis, table tennis, and badminton prior to the pandemic and cycling, walking, and jogging during the pandemic (Activities reported during the pandemic: cycling, walking, running). The number of days the participants participated in a physical activity for 45 minutes or more per week was higher prior to the pandemic than during the pandemic.

Table 3: Result of activity, sleep, sitting/lying down, and screen-time variables pre-pandemic and during the pandemic (n=79)

Variables	Test	$\bar{X}$±Sd	Statistical test	p
Days per week of 45 min of PA	Pre-pandemic	3.50±1.22	t:13.61	0.01
	During pandemic	1.96±1.25		
Daily sleep time on weekdays/hour	Pre-pandemic	7.72±0.60	t:-11.63	0.01
	During pandemic	8.68±0.75		
Daily sleep time on the weekend/hour	Pre-pandemic	8.39±0.71	t:-14.39	0.01
	During pandemic	9.62±0.80		
Daily sitting/lying down time on weekdays/hour	Pre-pandemic	3.88±1.19	t:-20.92	0.01
	During pandemic	5.42±1.43		
Daily sitting/lying down time on the weekend/hour	Pre-pandemic	4.33±0.94	t:-16.91	0.01
	During pandemic	6.25±1.34		
Daily screen-time on weekdays/hour	Pre-pandemic	4.25±1.32	t:-15.51	0.01
	During pandemic	6.12±1.48		
Daily screen-time on the weekend/hour	Pre-pandemic	4.89±1.67	t:-15.12	0.01
	During pandemic	7.17±1.61		
t: Paired Sample t-test, z: Wilcoxon test, PA: physical activity				

There is a statistically significant difference between the pre-test and post-test values of the weekly PA duration [t(75)=13.61 p<0.05]. The mean values of the pre-test (3.50±1.22) are lower than the post-test values (1.96±1.25). Participants also reported spending fewer hours per day sitting, sleeping, watching screens (television, tablet, cell phone) pre-pandemic during both weekdays and weekends.

There is a statistically significant difference between the pre-test and post-test values of daily sleep time on weekdays [t(75)=-11.63 p<0.05]. The mean values of the pre-test (7.72±0.60) are lower than the post-test values (8.68±0.75).

There is a statistically significant difference between the pre-test and post-test values of daily sleep time on the weekend [t(75)=-20.92 p<0.05]. The mean values of the pre-test (8.39±0.71) are lower than the post-test values (9.62±0.80).

There is a statistically significant difference between the pre-test and post-test values of daily sitting/lying down time on weekdays [t(75)=-14.39 p<0.05]. The mean values of the pre-test (3.88±1.19) are lower than the post-test values (5.42±1.43).

There is a statistically significant difference between the pre-test and post-test values of daily sitting/lying down time on the weekend [t(75)=-16.91 p<0.05]. The mean values of the pre-test (4.33±0.94) are lower than the post-test values (6.25±1.34).

There is a statistically significant difference between the pre-test and post-test values of daily screen-time on weekdays [t(75)=-15.51 p<0.05]. The mean values of the pre-test (4.25±1.32) are lower than the post-test values (6.12±1.48).

There is a statistically significant difference between the pre-test and post-test values of daily screen-time on the weekend [t(75)=-15.12 p<0.05]. The mean values of the pre-test (4.89±1.67) are lower than the post-test values (7.17±1.61).

Participants also reported the consumption of carbohydrates, french fries, chocolate, confectionery, juice, cola, and lemonade increased, and the consumption of water, fresh fruits, and vegetables decreased during the pandemic on weekdays.

Table 4 shows the result of eating/drinking variables pre-pandemic and during the pandemic.

Table 4: Result of eating/drinking variables pre-pandemic & during pandemic (n=79)

Variables	**Test**	$\bar{X}$**±Sd**	**Statistical test**	**p**
Consumption of fresh fruits	Pre-pandemic	3.78±1.63	t:14.40	0.01
	During pandemic	2.11±1.33		
Consumption of vegetables/salad	Pre-pandemic	2.14±1.03	t:14.41	0.01
	During pandemic	0.86±0.76		
Consumption of pasta/noodles	Pre-pandemic	1.09±0.94	t: -10.79	0.01
	During pandemic	2.01±0.89		
Consumption of bread	Pre-pandemic	4.88±1.56	t:-6.33	0.01
	During pandemic	5.49±1.36		
Consumption of french fries	Pre-pandemic	1 (1.0-2.0)	z:7.09	0.01
	During pandemic	2 (1.0-3.5)		
Consumption of confectionery, chocolate, etc.	Pre-pandemic	2.05±1.38	t:-13.89	0.01
	During pandemic	3.87±1.31		
Consumption of salty snacks (chips, etc.)	Pre-pandemic	1.79±1.53	t:-12.02	0.01
	During pandemic	3.82±1.76		
Consumption of water (daily)	Pre-pandemic	1.5 (1.5-2.0)	z:7.51	0.01
	During pandemic	1 (1.0-1.3)		
Consumption of milk	Pre-pandemic	4.74±1.74	t:2.03	0.05
	During pandemic	4.29±1.25		
Consumption of juice	Pre-pandemic	2.37±0.98	t:-19.36	0.01
	During pandemic	4.09±1.11		
Consumption of lemonade, cola, beverages	Pre-pandemic	1.53±1.47	t:-14.62	0.01
	During pandemic	3.25±1.48		
t: Paired Sample t-test, z: Wilcoxon test				

There is a statistically significant difference between the pre-test and post-test values of fresh fruits consumption [$t(75)=14.40$ $p<0.05$]. The mean values of the pre-test (3.78±1.63) are higher than the post-test values (2.11±1.33).

There is a statistically significant difference between the pre-test and post-test values of fresh vegetables/salad consumption [$t(75)=14.41$ $p<0.05$]. The mean values of the pre-test (2.14±1.03) are higher than the post-test values (0.86±0.76).

There is a statistically significant difference between the pre-test and post-test values of pasta/noodles consumption [$t(75)=-10.79$ $p<0.05$]. The mean values of the pre-test (1.09±0.94) are lower than the post-test values (2.01±0.89).

There is a statistically significant difference between the pre-test and post-test values of bread consumption [$t(75)=-6.33$ $p<0.05$]. The mean values of the pre-test (4.88±1.56) are lower than the post-test values (5.49±1.36).

There is a statistically significant difference between the pre-test and post-test values of french fries consumption [z:7.09 p<0.05]. When looking at the median values, the pre-test values (1 (1.0-2.0)) are lower than the post-test values (2 (1.0-3.5)).

There is a statistically significant difference between the pre-test and post-test values of consumption of confectionery, chocolate, etc. [t(75)=-13.89 p<0.05]. The mean values of the pre-test (2.05±1.38) are lower than the post-test values (3.87±1.31).

There is a statistically significant difference between pre-test and post-test values of the consumption of salty snacks/chips etc. [t(75)=-12.02 p<0.05]. The mean values of the pre-test (1.79±1.53) are lower than the post-test values (3.82±1.76).

There is a statistically significant difference between the pre-test and post-test values of the daily water consumption [z:7.51 p<0.05]. When looking at the median values, it is seen that the pre-test values (1.5 (1.5-2.0)) are higher than the post-test values (1 (1.0-1.3)).

There is a statistically significant difference between the pre-test and post-test values of juice consumption [t(75)=-19.36 p<0.05]. According to the average values, the pre-test values (2.37±0.98) are lower than the post-test values (4.09±1.11).

There is a statistically significant difference between the pre-test and post-test values of lemonade, cola, and beverage consumption [t(75)=-14.62 p<0.05]. The mean values of the pre-test (1.53±1.47) are lower than the post-test values (3.25±1.48).

4. Discussion

This study aimed to investigate the changes in physical activity, time spent sitting, lying down, and sleeping, screen-time, and food habits of young people with ASD during the COVID-19 pandemic full lockdown. The obtained data support the hypotheses that a two-week full lockdown will negatively affect the participation of young people with ASD in physical activity, increase the time they spent sitting, sleeping, and watching screens, and negatively affect their food habits. In general, it was seen that the duration of physical activity decreased, the sitting and lying down time increased, the time spent in front of screens was prolonged, the consumption of carbohydrates, french fries, chocolate, confectionery, juice, cola, and lemonade increased and the consumption of water, fresh fruits and vegetables decreased. Also, the number of activities attended by young people decreased. Although the study included only a two-week period, the obtained data support the concern that the COVID-19 pandemic will negatively affect the health-related behavior of young people with ASD (Esentürk, 2020).

Garcia et al., (2020), in a similar study conducted on a limited sample group of nine people in the USA, investigated the effects of a six-week lockdown on health behaviors such as physical activity, sleep, and screen-time. In the study, they reported results that support our study by indicating that the duration of physical activity decreased and the time spent in front of screens increased during the pandemic (Garcia et al., 2020). In the USA sampling, it was reported that weekday screen-time increased from 3.69 (2.66) hours to 6.25 (4.24) hours, while we determined that weekday screen-time increased from 4.25

(1.31) hours to 6.11 (1.47) hours, and it can be assumed that the average time spent in front of screens has similar values in both studies. When looking at sleep duration, it was determined that the participants in the USA sampling slept about one hour more on weekdays and weekends than the participants in the German sampling. It is believed that this difference is because the assessment of sleep in the USA sampling was better predicted during the 6-week lockdown process.

In another study, Wachob & Lorenzi (2015) investigated the sleep quality of 10 children with ASD, aged between 9 and 16, during the pandemic period with accelerometer devices that they carried for 7 days. At the end of the study, it was found that more than half of the participants had sleep problems and that the quality of sleep of children and young people participating in physical activities was better (Wachob & Lorenzi, 2015). Although the study of physical activity and sleep quality is not among the hypotheses of our current study, since the duration of physical activity decreased during the pandemic and the duration of sleep increased, it can be concluded that there may be an association between physical activity and sleep patterns.

The results of a similar study conducted in Canada with neurotypical adolescents support our study by showing that during the COVID-19 lockdowns, children and teenagers were less physically active, engaged in more screen-based activities, and slept more during the period compared to the period before the pandemic (Moore et al., 2020). Although the results are similar, the fact that the survey evaluations were made by the families in the other study makes it different from this study. Assuming that families cannot constantly monitor children during the day, it is believed that conducting the survey assessment by the young people themselves may produce different results.

This study is the first research comparing the nutritional behaviors of young people with ASD before and after the lockdown due to the COVID-19 pandemic. An important finding of this study is that the eating and drinking behaviors of children with ASD are negatively affected by the COVID-19 pandemic. While there are studies on the nutritional behaviors of young people with ASD in the literature (Goldschmidt & Song, 2016; Kim & Kang, 2020; Must, 2014), it is seen that there is only one study examining the nutritional behaviors during the COVID-19 pandemic (Shurack, 2020). It was determined that a two-week online nutrition program with 11 young people with ASD had a positive effect on their eating habits, and it was assumed that eating habits could be negatively affected by the COVID-19 pandemic if participants did not receive nutritional assistance (Shurack, 2020). Although this study differs from our current study in terms of application and content, it is seen that the obtained data coincide with the assumption that the COVID-19 pandemic may adversely affect eating habits.

In this study, similar results were achieved after the lockdown ended. Although staying at home during the COVID-19 quarantine process is considered a basic safety measure that can limit the spread of infections, increasing the time spent at home may result in sleep disorders, reduced participation in physical activity, and consumption of more food than usual, which may pose a health risk. To minimize such health risks, it is assumed that maintaining regular physical activity and exercising routinely in a home

setting can be an important strategy for healthy living during the COVID-19 pandemic (Esentürk, 2020; Yarımkaya & Esentürk, 2020).

5. Limitations

In the current study, the survey questions were answered by the children with ASD themselves. Therefore, there is a possibility that the participants may have misrepresented the information. However, controlling this is very difficult in the current COVID-19 pandemic conditions. Although the participants were told what to pay attention to during the answering process in the online seminar before the study, the reliability of the answers is open to prejudice.

6. Conclusion

In this study, it was hypothesized that the two-week COVID-19 pandemic full lockdown period in Germany would negatively affect the participation of young people diagnosed with ASD in physical activity, increase the time spent sitting, sleeping, and watching screens, and negatively affect their food habits. In line with these assumptions, this study aimed to investigate the changes in physical activity, time spent watching screens, sitting and sleeping times, and food habits of young people diagnosed with ASD and to contribute to the literature. In conclusion, during the COVID-19 quarantine period, it was observed that the frequency and duration of physical activity of young people with ASD decreased, the screen-time and the duration of sitting and lying down was extended, the consumption of foods such as carbohydrates, french fries, chocolate, confectionery, juice, cola, and lemonade increased, and the consumption of milk, water, fresh fruits, and vegetables decreased.

7. Recommendations

This study can contribute to gathering information about the response of young people with ASD to such lockdowns, making the necessary interventions for a healthy lifestyle, and taking precautions against health risks by setting an example for further studies.

In subsequent studies, the same questions may be applied to families and the answers given by participants and their families can be compared. In this study, information about the social status of the participants and their families was not collected. In further studies, such information including the educational status, income level, profession, and region of residence of the families can be collected and included in the evaluation.

Acknowledgements
The author also thanks all of the volunteers who dedicated their valuable time to this study. No funding has been received for the preparation of the present article, and the

authors have no association with any manufacturer that may benefit from the present study

Conflicts of interest statement
The authors declare no conflicts of interest.

About the Author
Ebubekir Aksay is currently a Lecturer in the Exercise and Sports for Disabled at Gelisim Ünivesity Istanbul and at TV Eberbach e.V. / Germany Department of Health, Rehabilitation and Disability Sport. His research interests include: Health, Rehabilitation and Disability Sport.

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