

# Long-term effect of migration background on the development of physical fitness among primary school children

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**Background:** Children with a low socioeconomic status and migration background are more likely to exhibit unfavorable health behavior patterns and higher BMI scores as well as lower physical activity and physical fitness.

**Aim:** To evaluate the effect of migration background on the development of physical fitness among primary school children from first to third grade.

**Methods:** In this longitudinal study, height, weight, and physical fitness of primary school children from Tyrol/Austria were measured five times over a period of 2.5 years using the German motor performance test DMT 6-18 consisting of eight items testing different subdomains of physical fitness.

**Results:** A total of 266 children (45% girls) participated in all five tests, of which 69 (26%) children reported to have a migration background (MB). Mixed-model ANOVA did not reveal a significantly different development of physical fitness (according to the mean total Z-score of DMT 6-18) over time,  $P = 0.883$ , partial  $\eta^2 < 0.01$ . However, children with MB showed significantly lower physical fitness compared to children without MB,  $P < 0.001$ , partial  $\eta^2 = 0.06$ . Controlling for BMI and age did not alter the interpretation of the results. Analyses of the single test items revealed significant differences in motor tests involving strength and endurance.

**Conclusion:** Primary school children with and without MB significantly increased their physical fitness over time in a comparable manner. However, children with MB showed a significantly lower physical fitness at all test time points, which was only partly explained by a higher mean BMI in children with MB. Children with MB outreached the mean baseline fitness level of children without MB not until the fourth test time point, that is after two years. Therefore, a special focus on physical fitness particularly including strength and endurance capacities should be directed to children with MB already in young ages.

## KEY WORDS

migration background, motor performance, overweight, physical fitness, primary school

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## 1 | INTRODUCTION

Childhood physical inactivity and obesity are two of the main public health problems of the twenty-first century.<sup>1,2</sup> In Western countries, a large proportion of children and adolescents do not meet the recommended physical activity guidelines as active behaviors have been displaced by more sedentary pursuits.<sup>3</sup> Pate et al<sup>4</sup> reported a mean sedentary time of about 6.1, 7.5, and 8.0 h/d in children 6-11, 12-15, and 16-19 years old, respectively. Recently, Kaiser-Jovy et al<sup>5</sup> found among a cohort of about 400 Austrian 10-14 years old secondary school students a mean time of self-reported media use (watching TV, surfing in the Internet, use of smartphone, playing computer etc) of 10.3 hours on a weekday and 12 hours on weekends. As Kaiser-Jovy et al<sup>5</sup> did not find a significant influence of hours of media use on sport activity, they concluded that a heavy media use is part of a complex juvenile leisure behavior and therefore rather a “time killer” with regard to sport activity and physical fitness. In general, physical fitness is subdivided into health-related fitness (cardiorespiratory endurance, muscular endurance and strength, body composition, flexibility) and skill-related fitness components (agility, balance, coordination, speed, power, reaction time) which can be tested by a single test item assessment (eg, “shuttle run” covering cardiovascular endurance) or by entire motor test batteries.<sup>6</sup> There is evidence that a decrease in physical fitness is associated with an increase in body mass index among children and adolescents.<sup>6,7</sup> In addition, excessive weight, physical inactivity, and a lack of fitness in young ages are associated with increasing prevalence of cardiovascular risk factors, orthopedic problems, and psychosocial constraints<sup>9,10</sup> leading to a reduced life expectancy of overweight people by several years.<sup>12</sup> Therefore, an early prevention of excess weight gain, low physical activity, and low physical fitness in young ages, for example during preschool or primary school, seems of utmost importance as physical activity is favorably associated with physical, psychological/social, and cognitive health indicators of children 5-17 years old.<sup>13</sup>

In their longitudinal study between 2008 and 2010 including 145 German primary school children, Augste et al<sup>8</sup> showed that physical activity has a direct positive influence on physical fitness. Physical fitness of school children partly depends on so-called modifiable factors as, for example, weight status, electronic media use, sport club participation, and on so-called non-modifiable factors as, for example, sex, socioeconomic status, or migration background.<sup>14</sup> Migration background was defined as present if they or at least one of their parents were born in a foreign country.<sup>8</sup> In a recent study by Hilpert et al<sup>15</sup> among a cohort of about 1000 German first graders with a median age of 7 years, children with a low socioeconomic status and migration background were more likely to exhibit unfavorable health behavior patterns, higher BMI scores, and poorer physical fitness. In addition,

studies reported a significant association between migration background and an elevated media use among children and adolescents.<sup>5,15</sup> Besharat Pour et al<sup>16</sup> showed that Swedish children whose parents were immigrants had a higher risk of having low physical activity and being overweight. In addition, Greier and Riechelmann<sup>17</sup> found among a cohort of more than 1000 Tyrolean preschool children a significantly lower physical fitness and a twofold higher prevalence of overweight or obesity among children with migration background. Ruedl et al<sup>14</sup> showed among a cohort of about 300 Tyrolean primary school children that migration background was a significant predictor for physical fitness among overweight and obese children but not among the non-overweight children. As Augste et al<sup>8</sup> found in their study that a migration background of the children negatively influenced physical activity and that physical activity had a direct positive influence on physical fitness, they recommended that a special focus should be directed to children with migration background. To our knowledge, up to now only few longitudinal studies investigated the development of physical fitness in young ages with regard to a migration background. Therefore, the aim of this study was to evaluate the association between migration background and the development of physical fitness among primary school children over a period of 2.5 years.

## 2 | METHODS

In this longitudinal study, 20 schools out of 361 primary schools in the federal state of Tyrol/Austria were randomly selected. The directors of 15 schools with 24 first grade classes agreed to participate. Out of 529 children, informed consent of the parents was obtained for 488 primary school children. Data were collected at five time points (from first to third grade), every autumn and spring, from 2014 to 2016. The study was performed according to the ethical standards of the 2008 Declaration of Helsinki and was approved by the educational board for Tyrol and the Institutional Review Board for Ethical Issues of the University of Innsbruck.

Inclusion criterion for this study was the participation of a child at all five test time points, that is a complete-case analysis. That means every child who missed at least one single test time point, for example due to an illness, was excluded from the analysis. As indicator for migration background, children were asked according to our earlier studies<sup>14,17</sup> whether the language spoken at home was German or another one.

Height and weight were measured with children wearing sport clothes and barefoot. The height measures were taken using a mobile stadiometer “Seca 217” (Seca, Hamburg, Germany) with an accuracy of 0.1 cm and the body weight was measured with a calibrated scale “Grundig PS 2010” (Grundig AG, Neu-Isenburg, Germany) with an accuracy of 0.1 kg. On the basis of these data, the BMI (kg/m<sup>2</sup>) was

calculated for every child. In line with the methods described in our earlier work,<sup>14</sup> we classified children with and without migration background according to their weight status into two groups: overweight (including overweight and obese children) and non-overweight (including anorexic, underweight, and normal weight children).

According to the work by Utesch et al.,<sup>6</sup> we understand the term physical fitness as a motor competence presuming a one-dimensional structure, which is defined as the ability to successfully complete a number of wide-ranging motor skills. Physical fitness was tested using the German motor performance test DMT 6-18,<sup>18</sup> a standardized test battery consisting of eight items testing different subdomains of physical fitness: 20-m sprint (sprint velocity), balancing backwards on three 3-m-long beams with different width (coordination in a task requiring precision), jumping sideward over a middle line for 15 seconds (coordination under time pressure), stand-and-reach (flexibility), push-ups in a period of 40 seconds (strength endurance), sit ups in a period of 40 seconds (strength endurance), standing long jump (power), and 6-minute run (endurance). According to Bös,<sup>18</sup> the inter-rater reliability (correlation coefficient = 0.95) and test-retest reliability (correlation coefficient = 0.82) of the test battery were good, and the battery has been validated for assessing speed, coordination, flexibility, strength, and endurance.

All tests were carried out by specially trained physical education students in the sports halls at the participating schools under the exact instruction of the published test manual.<sup>18</sup>

## 2.1 | Statistics

Data are presented as means  $\pm$  standard deviations and relative frequencies, respectively. Values of the eight test items were standardized using the norming sample with analogous age and sex according to Bös.<sup>18</sup> The guidelines of the test manual include multiplying the standardized score with 10 and add 100 to obtain a so-called Z-score, where 100 equals to average performance in the tests. Z-values above 100 mean over-average performance and Z-values below 100 under-average performance. A total Z-score as an indicator for the overall physical fitness level of the children was built according to Bös.<sup>18</sup>

Prior to the main analysis, sex, weight status (overweight vs non-overweight), body mass index, and age were tested on differences between children with and without migration background. Chi-square tests were used for sex and weight status and a  $2 \times 5$  mixed-model ANOVA was used for body mass index and age.

The primary analysis consisted of a  $2 \times 5$  mixed-model ANOVA to analyze the effect of migration background (migrants, non-migrants), time (Autumn 2014, Spring 2015, Autumn 2015, Spring 2016, Autumn 2016), and migration background by time interaction on physical fitness. A significant migration background effect was considered as a

different physical fitness between migrants and non-migrants, and a significant migration background by time interaction was considered as a different development of physical fitness over time. Dependent variables were total Z-score and subsequently the Z-scores of all single test items.

As a secondary analysis, body mass index and age were included as covariates to the model (ANCOVA) to assess if significant differences or different developments persisted after controlling for body mass index and age. ANCOVA was conducted using both the first and the last time point with identical interpretation of the results. Since the mean difference in body mass index was highest at the last time point (while the differences were comparable for age), only the analysis of the ANCOVA with last time point is presented. Dependent variable was the total Z-score.

Whenever the assumption of sphericity was not met in the ANOVA or ANCOVA, Greenhouse-Geisser correction was applied. Partial eta squared ( $\eta_p^2$ ) was used to quantify the effect size (small effect = 0.01; medium effect = 0.06, large effect = 0.14).<sup>19</sup> All *P*-values were two-tailed and values  $< 0.05$  were considered to indicate statistical significance.

## 3 | RESULTS

In total, 266 children (45% girls) participated in all five tests and, therefore, met the inclusion criterion. Mean age at baseline was  $6.4 \pm 0.5$  and at the fifth test time point  $8.4 \pm 0.5$  years. A total of 69 (26%) children reported to have a migration background. Body mass index, overweight group distribution, age, and sex distribution separately for children with and without migration background are displayed in Table 1. Sex distribution did not significantly differ,  $P = 0.550$ . Migrants showed a significantly higher mean body mass index,  $P < 0.001$ , showed a higher rate of overweight children at each time point,  $0.001 < P < 0.020$ , and were significantly older,  $P < 0.001$ , compared to non-migrants.

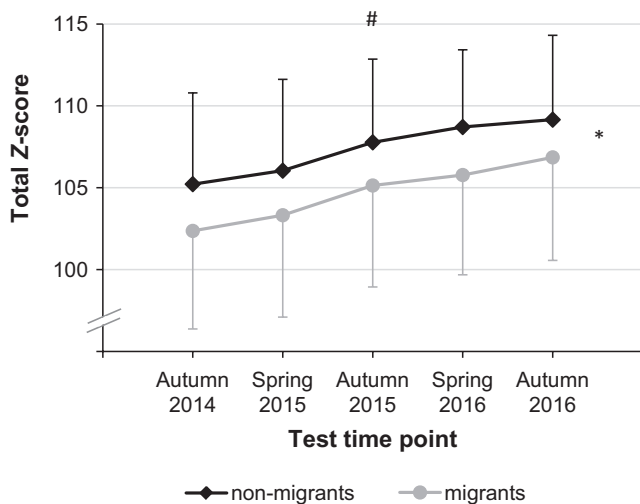
Figure 1 shows the mean total Z-scores of children with and without migration background at the five test time points. A significant main effect of migration background,  $P < 0.001$ ,  $\eta_p^2 = 0.06$ , and time,  $P < 0.001$ ,  $\eta_p^2 = 0.21$ , was found, indicating a higher physical fitness in non-migrants compared to migrants and an increase in physical fitness over time. No significant migration background by time interaction was found indicating similar development of physical fitness in children without and children with migration background,  $P = 0.883$ ,  $\eta_p^2 < 0.01$ .

Table 2 shows mean  $\pm$  SD total Z-scores and Z-scores of all eight single test items of children with and without migration background. Significant main effects of migration background were found for 20-m sprint, jumping sideward, push-ups, standing long jump, and 6-minute run, all  $P < 0.033$ ,  $0.01 < \eta_p^2 < 0.09$ . In all sub-disciplines, children

**TABLE 1** Weight indices, age, and gender distribution in children without (non-migrants) and with migration background (migrants)

Variable		Time point					P-value
		Autumn 2014	Spring 2015	Autumn 2015	Spring 2016	Autumn 2016	
Body mass index (mean ± SD)	Non-migrants	16.0 ± 1.8	16.1 ± 1.9	16.5 ± 2.2	16.5 ± 2.4	16.9 ± 2.5	<b>0.001</b>
	Migrants	16.7 ± 2.4	16.9 ± 2.6	17.5 ± 2.9	17.8 ± 3.2	18.3 ± 3.5	
Overweight group (%)	Non-migrants	8.2	11.7	13.7	14.2	16.8	<b>0.001 &lt; P &lt; 0.020</b>
	Migrants	18.2	23.2	30.4	27.5	34.8	
Age (mean ± SD)	Non-migrants	6.3 ± 0.5	6.8 ± 0.5	7.4 ± 0.5	7.7 ± 0.5	8.3 ± 0.5	<b>&lt;0.001</b>
	Migrants	6.7 ± 0.5	7.3 ± 0.5	7.7 ± 0.6	8.2 ± 0.5	8.6 ± 0.5	
Sex, female (%)	Non-migrants	46.2					0.550
	Migrants	42.0					

Bold values represent significant differences between migrants and non-migrants.



**FIGURE 1** Physical fitness level (mean total Z-scores) at five test time points among children without (non-migrants) and children with migration background (migrants). \*... indicates a significant main effect of migration background, #... indicates a significant main effect of time

without migration background showed significantly higher mean Z-scores indicating higher physical fitness level compared to children with migration background. Standing long jump did not show a significant main effect of time,  $P = 0.316$ ,  $\eta_p^2 < 0.01$ . All other sub-disciplines showed a significant main effect of time, all  $P < 0.028$ ,  $0.01 < \eta_p^2 < 0.32$ , indicating the increase in the sub-disciplines of physical fitness over time. None of the sub-disciplines showed a significant migration background by time interaction.

Including body mass index and age as covariates to the model did not change the interpretation of the results. Significant main effects of migration background,  $P = 0.027$ ,  $\eta_p^2 = 0.02$ , and time,  $P < 0.001$ ,  $\eta_p^2 = 0.03$ , were found for the total Z-score. No significant migration background by time interaction was evident,  $P = 0.140$ ,  $\eta_p^2 < 0.01$ .

## 4 | DISCUSSION

The aim of the current study was to evaluate the association between migration background and the development of physical fitness among primary school children. The main finding was that the development of physical fitness in children without and children with migration background did not significantly differ. However, children with migration background showed a significantly lower mean physical fitness level throughout the observation period compared to their classmates without migration background.

The proportion of children with migration background in this longitudinal study (26%) is well in accordance with cross-sectional studies by Greier and Riechelmann<sup>17</sup> among Tyrolean preschool children (25%), and by Ruedl et al<sup>14</sup> among Tyrolean primary school children (26%) and well comparable with a recent cross-sectional study by Kaiser-Jovy et al<sup>5</sup> among Tyrolean secondary school children (22%).

Children with migration background showed a significantly higher mean BMI compared to their classmates without migration background. In addition, the proportion of overweight and obesity (overweight group) among children with migration background was at all time points about two-fold significantly higher. This is in accordance with previous research that showed higher proportion of overweight and obesity in children with migration background.<sup>15,16</sup> Greier and Riechelmann<sup>17</sup> reported also a twofold higher prevalence of overweight and obesity among young preschool children with migration background (21.1% vs 10.4%).

Interestingly, percentage of the overweight group has doubled from the first to the fifth test among both groups. However, at the fifth test time point 35% of all children with migration background were in the overweight group compared to 17% of children without migration background. One could assume that this result might be partly caused by the higher sedentary behavior during school hours; however, there is limited evidence of a causal association between sedentary

**TABLE 2** Mean  $\pm$  SD total Z-scores and Z-scores of all test items of children without (non-migrants) and with migration background (migrants) at five test time points

Variable	Time point					P-value			Partial $\eta^2$		
	Autumn 2014	Spring 2015	Autumn 2015	Spring 2016	Autumn 2016	Migration background	Time	Migration background by time	Migration background	Time	Migration background by time
Total	105.2 $\pm$ 5.6	106.0 $\pm$ 5.6	107.8 $\pm$ 5.1	108.7 $\pm$ 4.7	109.2 $\pm$ 5.2	<0.001	<0.001	0.833	0.06	0.21	0.00
Migrants	102.4 $\pm$ 6.0	103.3 $\pm$ 6.2	105.1 $\pm$ 6.2	105.8 $\pm$ 6.1	106.9 $\pm$ 6.3						
20-m sprint	102.4 $\pm$ 9.0	104.4 $\pm$ 9.8	107.3 $\pm$ 7.3	108.7 $\pm$ 7.8	107.5 $\pm$ 8.5	<b>0.013</b>	<0.001	0.122	0.02	0.14	0.01
Migrants	99.2 $\pm$ 8.8	102.7 $\pm$ 8.9	104.0 $\pm$ 9.4	106.8 $\pm$ 9.4	106.8 $\pm$ 9.0						
Balancing backwards	105.6 $\pm$ 10.8	105.9 $\pm$ 10.5	106.8 $\pm$ 9.3	109.5 $\pm$ 9.0	108.8 $\pm$ 9.4	0.075	<0.001	0.217	0.01	0.05	0.01
Migrants	103.7 $\pm$ 10.4	104.1 $\pm$ 10.4	104.0 $\pm$ 9.6	109.0 $\pm$ 10.1	109.0 $\pm$ 8.6						
Jumping sideward	114.7 $\pm$ 10.6	117.0 $\pm$ 10.6	119.1 $\pm$ 9.5	121.7 $\pm$ 6.8	121.1 $\pm$ 6.2	<b>0.032</b>	<0.001	0.273	0.02	0.13	0.00
Migrants	113.5 $\pm$ 11.2	113.1 $\pm$ 11.1	117.4 $\pm$ 9.5	119.7 $\pm$ 6.6	119.7 $\pm$ 6.8						
Stand-and-reach	101.5 $\pm$ 9.2	102.5 $\pm$ 10.3	102.2 $\pm$ 9.8	101.0 $\pm$ 12.3	102.1 $\pm$ 10.7	0.197	<b>0.027</b>	0.708	0.01	0.01	0.00
Migrants	102.3 $\pm$ 10.0	104.5 $\pm$ 9.9	104.2 $\pm$ 10.1	103.3 $\pm$ 10.3	103.3 $\pm$ 9.6						
Push-ups	108.1 $\pm$ 10.4	111.8 $\pm$ 11.5	116.9 $\pm$ 9.1	119.4 $\pm$ 7.0	121.6 $\pm$ 6.4	<b>0.018</b>	<0.001	0.778	0.02	0.31	0.00
Migrants	106.3 $\pm$ 10.6	109.2 $\pm$ 10.1	114.0 $\pm$ 9.7	120.1 $\pm$ 7.0	120.1 $\pm$ 7.6						
Sit ups	99.7 $\pm$ 7.2	99.8 $\pm$ 6.5	101.9 $\pm$ 6.9	103.6 $\pm$ 6.4	103.8 $\pm$ 6.9	<0.001	<0.001	0.300	0.08	0.07	0.00
Migrants	96.7 $\pm$ 9.2	96.5 $\pm$ 8.8	97.2 $\pm$ 8.2	99.3 $\pm$ 9.5	99.3 $\pm$ 10.1						
Standing long jump	103.1 $\pm$ 9.1	103.4 $\pm$ 8.9	102.9 $\pm$ 8.5	101.9 $\pm$ 9.1	103.7 $\pm$ 8.4	<b>0.001</b>	0.316	0.285	0.04	0.00	0.00
Migrants	99.9 $\pm$ 10.8	98.4 $\pm$ 10.5	99.7 $\pm$ 10.8	99.2 $\pm$ 10.4	99.2 $\pm$ 10.9						
6-min run	103.5 $\pm$ 11.2	102.8 $\pm$ 12.2	104.5 $\pm$ 9.8	101.2 $\pm$ 13.0	103.5 $\pm$ 12.2	<0.001	<0.001	0.146	0.09	0.03	0.01
Migrants	95.7 $\pm$ 13.4	97.0 $\pm$ 13.1	100.0 $\pm$ 11.2	95.8 $\pm$ 11.6	95.8 $\pm$ 11.3						

Bold values represent significant effects.



behavior and adiposity in children and youth.<sup>20</sup> Moreover, Keane et al<sup>21</sup> recently found among 8- to 11-year-old children that time spent sedentary was not associated with overweight and obesity while time spent at moderate-to-vigorous physical activity (MVPA) was inversely associated with the risk of overweight and obesity independent of total sedentary time. Therefore, teachers of primary school children should be aware of the importance to increase MVPA also during school hours. There seems some evidence that daily lessons in physical education reduce adiposity and show a significant lower rise in BMI during primary school.<sup>22-24</sup> Thus, evidence-based preventive measures to decelerate the rise in BMI of primary school children should be implemented at the earliest.

Both groups of children in the current study showed a significant increase in the overall physical fitness over the time period of 2.5 years. Children with migration background, however, showed at all 5 time points a lower level of physical fitness and these differences remained constant over time (see Figure 1). The lower level of physical fitness among children with migration background might be partly caused by the two-fold higher prevalence of overweight and obesity among those children as excess body fat of overweight and obese children is an extra load to be moved during weight-bearing tasks.<sup>25</sup>

In the present study, when the effect of BMI was controlled for in an ANCOVA, partial  $\eta^2$  for migration background dropped from 0.06 to 0.02 indicating an influence of BMI on the effect physical fitness of primary school children. However, the significant effect of migration background persisted after controlling for BMI, what indicates that BMI cannot be considered as the only explanation for the lower level of physical fitness in children with migration background. This result is in contrast to previously conducted multivariate analyses with regard to physical fitness, where it was found that BMI was the strongest predictor while migration background was not an independent predictor for physical fitness<sup>14,26,27</sup> indicating that not a migration background per se but the higher proportion of overweight or obese children with migration background is a risk factor for lower physical fitness. A potential explanation for the differing results could be different study designs as well as different statistical approaches.

Moreover, mean total Z-scores of children with migration background outreached the mean baseline total Z-score of children without migration background not until the fourth time point, that is after two years (see Figure 1). In accordance, Greier and Riechelmann<sup>17</sup> found already among Tyrolean preschoolers aged 4 and 5 years an existing difference within physical fitness to the disadvantage of children with migration background and this result remained even when correcting for potential confounders, including age, size of the community, and overweight. Beside the higher prevalence of overweight and obesity, the lower fitness level of children with migration background may be partly caused by an unfavorable and insufficient level of activity

in the children's leisure-time as results of the MoMo-Study in Germany showed significant effects of a migration background on the level of physical activity in the children's leisure-time.<sup>28</sup> Our results reveal that it seems hardly possible to catch up this baseline deficit in physical fitness in the school setting without additional physical activity outside the school, for example in organized sports. In our earlier work among a cohort of primary school children,<sup>14</sup> we found that active participation in a sports club was a significant predictor for a higher physical fitness in non-overweight and overweight children. Also Golle et al<sup>29</sup> showed in a 4-year longitudinal study a significantly better motor performance development for endurance and lower-extremity strength for children continuously participating in sports clubs compared to their non-participating peers. However, as migration background seems to be associated with a reduced participation in organized sports,<sup>30</sup> more attempts are necessary to increase the number of children with migration background within organized sports.

Regarding results from the single test items in Table 2, children without migration background showed significantly higher mean Z-scores at all five time points within all tests except balancing backwards and stand-and-reach test. The latter result is in contrast to Greier and Riechelmann<sup>17</sup> where preschool children without migration background achieved significantly better results in the stand-and-reach test as well. Nevertheless, our results reveal that there seems a gap of strength and endurance capacities of children with migration background compared to their classmates without migration background which might be a potential risk factor for cardiovascular diseases and orthopedic problems later on. Therefore, according to Greier and Riechelmann<sup>17</sup> and Augste et al<sup>8</sup> preventive and health promoting measures should be implemented as early as possible, with a special focus on children with migration background. However, to implement effective interventions it seems important to address specific factors influencing physical activity and sedentary behavior among ethnic minority groups living in Europe.<sup>31</sup>

A few limitations have to be considered. Firstly, the complete-case analysis may be considered as a weakness especially since differences between children with and without migration background were found (data not presented). Therefore, the results might be biased due to a selection bias. However, since excluded children showed a significantly higher percentage of migration background and lower fitness values, it is assumed to result in an underestimation of the differences between children with and without migration background. Connected to that, all data were collected in Tyrolean children what might not be representative for all Austrian primary school children. Secondly, the data were collected in 14 different schools with up to 4 classes. Our analysis did not account for clustering in the data structure. Although additional analyses

(not presented in the results section) indicated that physical fitness differed similarly between children with and without migration background across classes and schools, this approach might have resulted in overestimation of the effect sizes for migration background. Therefore, future research might consider alternative statistical approaches to account for data clustering (eg, multilevel linear modeling) and analysis strategies (eg, multiple imputation analysis instead of complete-case analysis). In addition, potentially confounding variables such as education attainment or economic possibilities of parents and others should be included to get more insight in a health-related development of our children. Strengths of the study, however, are the relatively large sample size and the longitudinal nature of the investigation.

## 5 | PERSPECTIVES

In this study, no evidence for a significantly different development of physical fitness in primary school children with and without migration background was found. However, children with migration background showed a significantly lower physical fitness at all test time points, which was only partly explained by a higher mean BMI in children with migration background. Children with migration background outreached the mean baseline fitness level of children without migration background not until the fourth test time point, that is after two years. Therefore, a special focus on physical fitness particularly including strength and endurance capacities should be directed to children with migration background already in young ages.

## ACKNOWLEDGEMENT

We gratefully acknowledge the help of students from the Department of Sport Science of the University of Innsbruck, Austria, conducting the motor performance tests and interviews.

## CONFLICT OF INTEREST

None.

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**How to cite this article:** Ruedl G, Ewald P, Niedermeier M, et al. Long-term effect of migration background on the development of physical fitness among primary school children. *Scand J Med Sci Sports*. 2019;29:124–131. <https://doi.org/10.1111/sms.13316>