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Child's School Entry Health Examination Reveals Social Differences in Body Composition, Physical Activity and Stage of Motor Development

Schuleingangsuntersuchung offenbart soziale Unterschiede bei Körperkomposition, Bewegungsverhalten und motorischem Entwicklungsstand

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ZUSAMMENFASSUNG

Im Sinne einer ganzheitlichen Entwicklung sollten schulfähige Kinder neben kognitiven und sprachlichen auch über motorische Kompetenzen verfügen. Hohe Bewegungsaktivität in der Kindheit unterstützt zudem die Prävention vor Übergewicht und Adipositas im Jugend- und Erwachsenenalter, Überbelastungen des Halte- und Stützapparates sowie Erkrankungen des Herz-Kreislaufsystems. Um Frühindikatoren für einen gesunden Lebensstil zu finden und zielgerichtete Fördermaßnahmen zu ermöglichen, erfolgte in dieser Studie eine Fokussierung auf den motorischen Entwicklungsstand und das Bewegungsverhalten von Vorschulkindern sowie auf soziale Einflüsse auf diese Faktoren. 1.489 Kinder nahmen an der Einschulungsuntersuchung für das Schuljahr 2011/2012 und an sportmotorischen Tests teil. Über Elternfragebögen wurden Freizeitaktivitäten der Kinder sowie Sprachhintergrund und Bildungsstand der Eltern erfasst. Die Daten wurden deskriptiv und inferenzstatistisch ausgewertet. Sowohl ein geringer Bildungsstand der Eltern als auch ein nicht-deutscher Sprachhintergrund zeigten starke Zusammenhänge mit Übergewicht, weniger körperlicher Aktivität und höherem Medienkonsum der Kinder. Signifikant weniger Kinder aus diesen Familien konnten bereits Fahrradfahren und Schwimmen. Für diese Kinder zeigten sich auch Nachteile im Standweitsprung, nicht jedoch im Balancieren und Hin- und Herspringen. Normalgewichtige Kinder schnitten in allen motorischen Testaufgaben am besten ab. Um ähnliche kognitive, emotionale und aktionale Grundlagen für ein gesundes und bewegungsaktives Leben zu gewährleisten, muss folglich verstärkt darauf geachtet werden, explizit Kinder aller Schichten und Kulturen mit Bewegungsangeboten anzusprechen. Damit könnte ein bedeutender Beitrag für die Gesundheit und die Gesamtentwicklung der kindlichen Persönlichkeit geleistet werden.

Schlüsselwörter: Übergewicht, Migrationshintergrund, Bildungsstand, motorische Leistungsfähigkeit, Einschulungsuntersuchung.

INTRODUCTION

In the context of developmental- and learning-theory pre-school age assumes a special status within the biography of young children, who experience a significant turning point and genuine complexity in their transition from kindergarten to primary school (11). The time for this transition in principle takes place in the calendar year of the sixth birthday, while the definite assessment of school preparedness and respective competencies is however determi-

SUMMARY

Aiming at a holistic development, children starting school should not only possess cognitive and linguistic, but also motor competences. High physical activity in childhood also sustains the prevention of overweight and obesity in youth and adulthood as well as of cardiovascular diseases. To find early indicators for a healthy lifestyle, the study focussed on the motor behaviour and development of preschool children and on the social influences on these factors. 1,489 children participated in the school-entry health examination for the year 2011/2012 and in the motor tests. Data on leisure time activities of the children and on parents' native language and educational background were acquired by questionnaires. Strong associations were found for the educational and language background of parents with children's BMI, physical activity and media consumption. Significantly fewer children of families with lower educational background and of families with migration background had learned to swim or to ride a bike. Those children also performed worse in the standing long jump, but not in the balancing task and in bidirectional jumping. Normal-weight children reached the best results in all motor tasks. To provide a similar base for a healthy and active life, it has to be ensured that children of all cultures and social classes are addressed with activity programmes. This could be an important contribution to a healthy and holistic development the child's personality.

Key Words: obesity, migration background, educational background, motor abilities, coordination.

ned by means of the school-entry examinations by the local health officials. In the context of these legally obligatory assessments,

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Table 1: Physical constitution of the children depending on educational level and language background of the parents. N: number of tested children, M: mean, SD: standard deviation, p: group differences in the t-Test.

	total	male	female	education level		p	language background			
				low	high		German	mixed	p	
Age [months]	N	1486	763	722	408	471	0,092	678	764	0,305
	M	69,4	69,5	69,3	69,7	69,2		69,3	69,5	
	SD	3,8	3,9	3,7	3,9	3,7		3,9	3,7	
Height [cm]	N	1479	761	717	407	469	0,138	675	761	0,656
	M	116,1	117,0	115,3	115,9	116,4		116,2	116,1	
	SD	5,2	5,2	5,0	5,4	4,9		5,3	5,1	
Weight [kg]	N	1477	759	717	405	469	<0,05	675	759	<0,001
	M	21,0	21,3	20,7	21,3	20,8		20,6	21,4	
	SD	3,4	3,4	3,4	3,8	3,0		3,0	3,7	
BMI [kg/m ²]	N	1477	759	717	405	469	<0,001	675	759	<0,001
	M	15,5	15,5	15,5	15,8	15,3		15,2	15,8	
	SD	1,7	1,7	1,8	1,9	1,6		1,5	1,9	

which differ from state to state and are determined by the federal structure of the education system, the potential for successful school attendance is recorded in addition to documentation of the participation in necessary preventative measures and the survey of physical-medical parameters of prognosis variables. In addition to tasks regarding assessment of the emotional, social and cognitive level of development, tests regarding every-day-based coordination, fine-motor and grapho-motor skills are implemented (6). If one additionally takes into consideration, in this context, the positive correlation of sport activities involving movement and motor-performance skill in infancy (15,25), then an intensive focus on physical activity behaviour and motor skill development appears to be desirable in the context of sport-based and/or medicine-based data:

- Relevance to developmental psychology: movement and respective motor-skill level represent the infantile primary potential regarding active development of the personal and material environment (28,33).
- Relevance to learning-theory: physical activity and skills exert a positive influence on the capacity to learn. Physiological and neuronal reinforcement through movement have been documented here for cognitive and linguistic development (29,34). Underdeveloped motor competencies and psychomotor abnormalities can influence the social comfort of a child in a negative way and hinder the learning and performance capacity (6).
- Relevance to preventative health: lack of movement and motor deficits in infancy are risk-factors and/or predictors of morbidity in the adolescent and adult age groups. This is indicated primarily through overweight and obesity, over-exertion of the body's supporting muscles, tendons and ligaments as well as diseases of the cardio-vascular system (12,13).

Contrary to previous significance, it is nevertheless well-known that children in the pre-school ages, regarding activity behaviour and motor skills, are considerably differentiated from one another (16). Moreover, there have been increasing indications in recent years from the data of diverse school-enrolment evaluations of the public health service (8,9,18) as well as sport-scientific studies (7) showing motor-developmental delays and health-related

disturbances in pre-school age groups. These document, for the schoolchildren and adolescents, clear correlations to socio-economically and culturally influenced variables and sports activities (3,22,24,27,32), but show little evaluated correspondence for the pre-school target group of this study (4,14).

In connection with essential relevance for the overall development of successful participation within the school system and the age-related insufficient data, it should therefore be evaluated in a large-scale cross-sectional study - to what degree various social factors influence the physical activity behaviour and motor-skills of children during the late pre-school age.

MATERIAL UND METHODS

Concerning the school-entry examination by the health department Augsburg, all children who reached the calendar age for obligatory school attendance by September 2011, were requested to attend about 2 to 3 months prior to their sixth birthday. For 77.2% of the pre-schoolers (n=1.489), the parents agreed in written informed consent with participation in additional assessment of the leisure time behaviour and motor-skill development. For almost all of these children (99.2%), the complete data sets for analysis were able to be used. By means of a parent-questionnaire, the language background of the family, the educational level of the parents, the physical activity behaviour in summer and winter, activities in sport clubs and media consumption of the children were recorded in 4 to 7 scale categories. Furthermore, it was also recorded in the context of a parent questionnaire, whether the children were already able to swim and ride a bike. Answering of the questionnaire by the parents was carried out according to their best knowledge, but occasionally language issues or comprehension problems occurred, for which the staff attempted to give aid. Despite the aid, 2% of the attendant parents were not able to say whether their child could swim.

After the recording of body size and weight (without outer garments) by the medical experts, the motor fitness of the children was determined in the health department premises by previously-

Table 2: Physical behaviour and media consumption of the children depending on educational level and language background of the parents. N: number (%: percentage) of children, who fulfilled the criteria. p: group differences in the Chi²-Test.

	total		language background				p	educational level				p
	N	%	German	%	mixed	%		low	%	high	%	
My child ...	N	%	N	%	N	%		N	%	N	%	
is playing outdoors almost every day in summer	1356	91,9	669	94,5	682	89,5	<0,001	368	90,2	437	92,6	0,206
is playing outdoors almost every day in winter	523	35,4	288	40,7	232	30,3	<0,001	118	28,9	185	39,3	<0,01
is training in a sports club at least 1x/week	770	52,3	432	61,2	335	44,0	<0,001	132	32,4	325	69,0	<0,001
is watching TV at least 1 hour/day on weekdays	443	30,0	112	15,8	329	43,0	<0,001	172	42,1	83	17,6	<0,001
is watching TV at least 1 hour/day at the weekend	805	55,7	284	40,7	518	69,7	<0,001	273	68,8	187	40,5	<0,001
is playing electronic games at least 1 hour/day on weekdays	60	4,1	10	1,4	50	6,5	<0,001	17	4,2	11	2,3	0,118
is playing electronic games at least 1 hour/day on weekends	146	10,1	27	3,9	119	16,0	<0,001	53	13,5	21	4,5	<0,001

trained staff. Because of the general conditions, it was not possible within this study to check all possible motor skills; rather, the children completed three age-appropriate whole-body test assignments based on subtests of the motor-module, from which differential effects of the physical activity upon the motor fitness were shown in previous studies (4): balancing backwards (coordination under precision pressure), sideways to-and-fro jumping (coordination under time pressure) and standing long-jump (jumping power of the lower extremities).

Evaluation was carried out through the statistics programme SPSS 19. For the entries re-garding mean-values, standard deviations and frequencies, descriptive statistics were used. Group differences were checked with co-variance analyses and Chi²-tests. The significance level of the alpha-errors was set for all tests at .05.

RESULTS

Physical constitution, language background and educational level

The children were 51.3% male and 48.7% female. Table 1 shows the physical constitution of the children and the educational level and language background of the parents. In reference to the age-reference BMI percentile (17), 82% of the children had normal weight, 3% were extremely underweight, 6% were underweight, 5% overweight and 4% obese. For 52% of the children, at least one parent did not speak German as the mother tongue ("mixed language background"). Most frequent were the Turkish and Russian language backgrounds. Other nationalities appeared in relatively low percentages, yet there were more than 70 different languages under the Augsburg parents. For almost 28% of the children, a "low educational background" was attested, when both parents had not completed secondary school or had, at best, completed primary or middle school. For 32% of the children, at least one parent had studied at university. These children were allocated to the "high educational background" tier. Among the exclusively German-speaking

families, the proportion of parents who had received tertiary education (university) was above-average (42%), whereas especially among Turkish-speaking families there was conversely an over-proportional percentage of mothers and fathers with a low level of education (59%).

Physical activity behaviour

The leisure time physical activity and play behaviour fluctuated considerably according to the season. Particularly children with mixed language backgrounds and from non-academic households played outside, particularly in the winter, much less often. More than half of all pre-school children took advantage of the possibilities of regional sport clubs, but showed a strong correlation in this regard with family language background and educational level of the parents. Regarding media usage, children with low educational background and mixed language background had higher times of usage. On the weekends, children watched overall more television and played longer with electronic devices than on weekdays (Table 2).

Status of motor-skill development

As regards the skill of balancing backwards, the children achieved on average 8 of 16 possible steps. It should be mentioned here that there was a considerable difference in performance among the individual children. 13% of the children accomplished the whole length without contact with the floor, while 5% of the children accomplished no step whatsoever in 2 attempts. Also in the case of sideways to-and-fro jumping, an obvious difference in achievement was noted. While language background and educational level had no influence on these two motor-skill tests, the well-educated as well as the exclusively German-language children were significantly better at the standing long jump (Table 3). In reference to the gender, there were significant advantages for girls in balancing, while the boys showed advantages in the standing long jump and no differences in the to-and-fro jumping.

For all three sport-motor-skill tests, an optimal trend could be confirmed regarding the body weight. Normal weight children

Table 3: Status of motor-skill development of the children depending on educational level and language background of the parents. N: tested number, M: mean, SD: standard deviation, %: percentage of children, who fulfilled the criteria, p: group differences in the analysis of covariances with the covariates BMI und gender.

	total	educational level		p	language background		p	
		low	high		German	mixed		
Balancing [number]	N	1475	401	466	0,996	698	753	0,450
	M	8,2	8,3	8,3		8,1	8,2	
	SD	4,9	4,9	5,0		5,0	4,9	
Jumping [number]	N	1469	401	465	0,189	698	746	0,220
	M	28,9	28,6	29,6		28,6	29,2	
	SD	10,9	11,5	10,9		10,9	11,0	
Long jump [cm]	N	1484	402	468	<0,001	700	758	<0,01
	M	87,3	84,4	89,8		89,0	85,9	
	SD	17,5	16,8	17,0		17,4	17,4	
Child can swim	N	1489	402	466	<0,001	696	752	<0,001
	%	36,6	22,6	50,2		48,2	25,3	
Child can ride a bike	N	1489	409	472	<0,001	708	762	<0,001
	%	82,6	75,6	87,7		87,0	78,7	

finished above-average for all 3 tasks (positive z-value), conversely both overweight and underweight children were below average (negative z-value). The performance deficits here were the largest for the extremely overweight children for all tasks (Figure 1).

More than 80% of the children in pre-school age could ride a bike. Only one-third of the pre-schoolers, on the other hand, could swim. Here as well concerning the basic motor skills of everyday life, the results show a non-unified trend regarding the language background and educational background (Table 3).

DISCUSSION

Socio-economic and cultural differences as a causal network for differentiated developmental progress in physical development, physical activity behaviour and motor-skill level are comprehensively and empirically documented for the school children and adolescents, and are manifested for the pre-school target group of the presented study in broad sections.

If one observes the distribution of BMI groups, then it becomes apparent that, at 82%, the portion of normal-weight children, in comparison to regional data from the City of Augsburg, is fortunately relatively high. When compared to the results of a prevalence analysis in the context of the school-admission evaluation from the year 2006, the portion of overweight children sank by 4.1% (30) and the degree of underweight and overweight children with re-spectively 9% currently, is even under the generally empirical norm (17). This shows that regionally intended/initiated measures (Health Department Augsburg: Development and Implementation of a Communal Prevention Campaign) are able to achieve positive results. From the social and health-policy point of view, it is valid to say that in addition to the acute physical, mental and psychosocial negative effects during the juvenile developmental phase (19), the long on-going prevalence of overweight and obesity up to adult age and the respective consequential morbidity are to be monitored (26). The connection between overly-high BMI, inactive

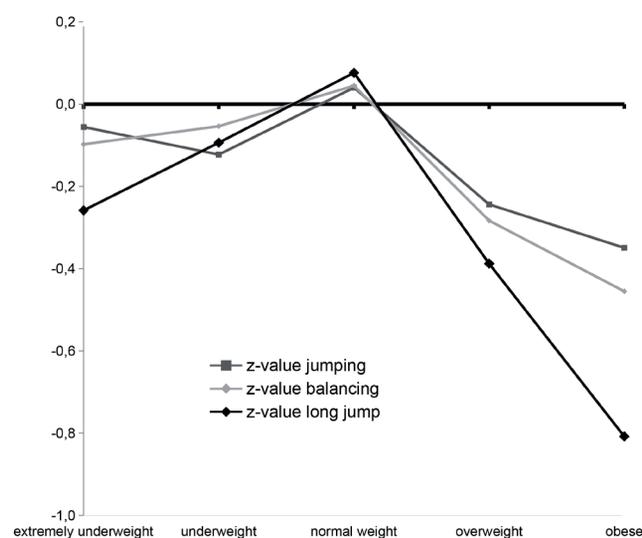


Figure 1: Motor skill test scores of the children compared across their body weight status.

physical behaviour (minimal movement time outdoors, increased media usage) and diminished motor-skill capacity, respectively, is known for this age group (2, 15, 20, 23), and is shown in the present study as well. Therefore, it is reasonable as early as pre-school years and independent of social status, to initiate the promotion of a healthy and active lifestyle and to integrate the real surroundings of the children (family, kindergarten, leisure time/everyday life, sport clubs, paediatricians) (5, 10). Special attention here should be given to the importance of daily movement and daily physical activity time. International recommendations suggest in this context a minimum of two hours per day for children of kindergarten age (21).

In addition to the BMI, the parental educational status as well and the family language background showed influence on the physical activity and motor-skill developmental status. Test individuals with mixed family language and low educational background

played less often outdoors in the winter, but also in the summer, spent significantly more time in front of a tele-vision and used electronic devices (Playstation, Xbox, Gameboy, Nintendo DS) significantly more often. This lack of physical activity clearly and statistically impacted, however, only one motor-skill task. As opposed to the significant results of the standing long-jump, the results of the backwards balancing and the sideways jumping indicated no substantial differences.

Similar to these findings from the relatively large sample in this study, social status and migration background influenced only several test tasks (4) in the German-wide "MoMo" study in which 600 children were tested from the age group 4 to 5 year olds. While a more inactive physical behaviour did not directly affect the conclusive and resultant motor performance for the age group examined in Augsburg, a widening of the gap within the same regional examination area is however clearly evident in the mid primary-school age (1).

Moreover, it should be taken into consideration here that all motor-skill test tasks were indeed considerably influenced by overweight, which in turn appeared quite often with children from low educational backgrounds and not exclusively German-speaking parental homes.

Therefore physical education should be used as a basis for pre-school holistic preventive training in the kindergarten, to which all of these children have access. While during bike-riding this form of active experiencing and perceiving of the closer surroundings in the pre-school age had still broken down for only a few children with mixed language background and low educational background, only one-quarter of the children with non-exclusively German family language could already swim prior to school commencement.

This is however contingent upon how it is presented, not through a lower motor-skill developmental status; rather, potentially through the culturally different significant value of this competence. Similarly, the distribution within families with lower social status was specified, so that it had to be assumed that financial aspects as well influence the participation in swimming classes. If one also views the dependence of swim capacity upon the parental educational status and considers in this context that only about one-third of the children and adolescents currently have command of the life-essential competency of swimming (32), an integration of swimming lessons could well be imagined in the pre-school curriculum. In any case, the closing down of public swimming pools and, in part, the accompanying reduction in school swimming lessons should be critically reviewed.

CONCLUSION

Even if the ascertainment of physical activity was based on the subjective estimation of the parents, and not all motor-skill aspects were able to be recorded, a significant gathering of new information could be targeted through the examination, in this very comprehensive study, with a large variability of education status and language background. In order to guarantee a positive motor-skill development and capability status in the pre-school age, a life-long (ideally) active leisure time behaviour, and a low overweight health-risk, it must be assured that children of all strata and cultures are offered physical activity in the pre-school age. With this, not only a similar cognitive, emotional and action-related basis for a healthy

and physically active life, rather, an equalization as well of the start-up conditions for a successful school attendance and a significant contribution to the overall development of the child personality could be accomplished.

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