

Kopczynski S¹, Chen-Stute A², Kellmann M^{1,3}

Attitudes Towards Physical Activity and Exercise Participation – a Comparison of Healthy-Weight and Obese Adolescents

Einstellung zu körperlicher und sportlicher Aktivität – eine vergleichende Analyse normalgewichtiger und adipöser Jugendlicher

¹Ruhr-University Bochum, Faculty of Sport Science, Bochum

²Institute of Nutritional Medicine, Oberhausen

³The University of Queensland, Schools of Human Movement Studies and Psychology, Brisbane, Australien

ZUSAMMENFASSUNG

Background: Physical activity and exercise are important in the prevention and treatment of adolescent obesity. The goal of non-stationary obesity treatment is to encourage long-lasting sport participation. From the motivational perspective, positive attitudes towards physical activity and exercise are a key and should be considered when developing obesity interventions. This study examined potential differences in attitudes towards physical activity and exercise between adolescents with body mass indices in obese and healthy-weight ranges. Methods: A questionnaire measuring attitudes toward, and current levels of physical activity and exercise was completed by 395 adolescents recruited from schools and 16 adolescents recruited from a non-stationary obesity treatment program. This one year obesity treatment program combined dietary, psychological and physical activity and exercise-related interventions administered under medical supervision. Results: Compared to adolescents in the healthy-weight range, obese peers showed less positive attitudes towards intensive exercise/sporting competition and risky sporting activities. Additionally, in both weight ranges an active lifestyle is attended by a higher value of training and competition plus social experiences in sports. Independent from weight status, more positive attitudes in "training and competition" and "social contacts" were related to physical and sport activity. Conclusions: These results suggest that training, competitive and risky activities offer a lower incentive for obese adolescents than for healthy-weight peers. Suggestions for joint physical and sport activities (e.g. in Physical Education) and sport relating interventions within the therapy of obesity are discussed.

Schlüsselwörter: obesity, health behaviour, physical activity, exercise

SUMMARY

Hintergrund: Die Bedeutung des Aktivitätsverhaltens zur Vorbeugung und Behandlung von Adipositas im Jugendalter ist hinreichend bekannt. Ein Ziel der ambulanten Adipositas-therapie ist die nachhaltige Förderung der Sportpartizipation. Unter motivationalen Gesichtspunkten ist die Entwicklung einer positiven Einstellung gegenüber körperlicher und sportlicher Aktivität erstrebenswert für eine dauerhafte Sportteilnahme. Daher erscheint die differenzierte Erfassung und Berücksichtigung der Einstellung adipöser Heranwachsender zu körperlicher und sportlicher Aktivität sinnvoll, um effektive Interventionsmaßnahmen zu entwickeln. Methode: Mittels schriftlicher Befragung wurde die Einstellung zum Sport und zu sportlicher Aktivität sowie Parameter des Sport- und Bewegungsverhaltens von 395 Schülern der Sekundarstufe I sowie 16 jugendlichen Teilnehmern eines ambulanten Adipositas-therapieprogramms erfasst. Das einjährige Programm beinhaltet eine Ernährungsschulung sowie psychologische und sporttherapeutische Maßnahmen unter ärztlicher Leitung. Ergebnisse: Im Vergleich zu normalgewichtigen Jugendlichen wiesen nicht-therapeutisch betreute adipöse Jugendliche eine weniger positiv geprägte Einstellung zu trainingsintensivem Wettkampfsport und risikobetonen Sportsituationen auf. Zudem ging ein sportlich aktiver Lebensstil in beiden Gewichtsklassen mit einem höheren Stellenwert von Training und Wettkampf sowie sozialem Erleben beim Sport einher. Unabhängig vom Körpergewichtstatus ließen sich positiver geprägte Einstellungen zu körperlicher und sportlicher Aktivität für „Training und Wettkampf“ sowie „Soziale Kontakte“ beobachten. Schlussfolgerungen: Die Ergebnisse legen nahe, dass trainings-, wettkampf- und risikobetonen Aktivitäten für adipöse Jugendliche in geringerem Maße als Anreiz fungieren als bei normalgewichtigen Altersgenossen. Hieraus ableitbare Empfehlungen für die Gestaltung von gemeinsamen Sportaktivitäten (z.B. im Schulsport), sowie für sportbezogene Interventionen in der Adipositas-therapie werden diskutiert.

Key Words: Adipositas, Gesundheitsverhalten, sportliche Aktivität, Bewegung

INTRODUCTION

The prevalence of adolescent obesity has increased considerably in recent decades. In particular, the percentage of obese adolescents has risen significantly, with current estimates at approximately 6% in Germany (19). Decreased physical activity has been suggested as a main cause of obesity (23). Numerous studies indicate that compared to healthy-weight range adolescents, obese adolescents have decreased physical fitness and motor abilities (12,17), and lower levels of physical activity and exercise (15).

In an effort to explain and to predict behavior, social psychologists have explored underlying attitudes. Similarly, sports scientists have investigated how attitudes influence physical activity

accepted: April 2014

published online: May 2014

DOI: 10.5960/dzsm.2014.113

Kopczynski S, Chen-Stute A, Kellmann M: Attitudes Towards Physical Activity and Exercise Participation – a Comparison of Healthy-Weight and Obese Adolescents. Dtsch Z Sportmed. 2014; 65: 139 - 143.

and exercise behaviors. Attitudes are defined as individual value dispositions – in terms of approval or disapproval – toward a social object (9). Attitudes can manifest on three levels: cognitive (beliefs, opinions), affective (emotions), and behavioral (actions). According to Eagly and Chaiken (9), behavioral attitudes encompass both intentions to act and overt behavior.

Research indicates that in comparison to healthy-weight range adolescents, obese adolescents may have different attitudes towards physical activity and exercise (7). Attitudes develop through past experience. Consequently, as obese adolescents are prone to teasing during exercise, they are more likely to develop negative attitudes towards physical activity and exercise as a result of past negative experiences (26). Furthermore, obese adolescents experience physical activities more wearing than healthy-weight adolescents (21). This could have been a long-lasting impact on their attitude towards exhausting physical activities and sport participation (22). As studies indicate that obese adolescents are less committed to sports than healthy-weight range adolescents (27), and commitment to sport in youth is generally correlated with sport related attitudes (13), obese adolescents are more likely to have more negative attitudes towards sport than healthy-weight peers.

This study aimed to further investigate the differences in attitudes between obese and healthy-weight range adolescents towards physical activity and exercise participation. Additionally, we were interested in exploring if and to what extent current exercise behavior is associated with exercise-related attitudes in obese and healthy-weight range adolescents. Based upon the evidence presented above, we hypothesised that obese adolescents would show less positive attitudes toward physical activity and exercise than their healthy-weight range counterparts. We also expected that being physically active, as well as participating in club sport, would be associated with more positive attitudes towards physical activity. Furthermore, in alignment with Braet, Mervielde, and Vandereycken's (2) assertion that studies assessing the psychosocial characteristics of adolescent obesity must examine both clinical and non-clinical samples of obese children, this study sought to examine whether participation in clinical obesity treatment is associated with exercise-related attitudes that are different to those held by obese adolescents who are not in clinical treatment.

METHODS

Participants

A total of 395 school students, who were not currently participating in clinical obesity treatment and were recruited from four public schools in Germany, participated in this study. A second sample of 16 adolescents from a non-stationary obesity treatment program, run by the Obesity Centre Oberhausen and the Obesity Centre of the Bethesda-Johanniter Hospital Duisburg in Germany, also participated in this study (4). The one year intensive therapy program T.O.M. (Therapy of Obesity with Motivation) for obese children (8-12 years) and adolescents (13-17 years) is based on behaviour therapy and contains an interdisciplinary therapy program with behaviour and dietary education once a week as well as sports therapy thrice weekly in groups under medical supervision (4).

Participants were aged between 11 and 16 years ($M = 13.9$, $SD = 1.28$ years). Parents provided written parental consent for partici-

pation. The study had proper institutional approval and was carried out in accordance with universal ethical principles.

Measures

Attitudes Towards Physical Activity and Exercise: The "Assessment of Attitudes Towards Physical Activity and Sport-Participation" (10) questionnaire was used to measure participants' attitudes towards physical activity and exercise participation. This scale was constructed using Kenyon's (16) conceptual model of exercise. Kenyon's model emphasises the importance of instrumental values, and asserts that exercise has a satisfying function in relation to social experiences, health and fitness, the pursuit of vertigo, aesthetic experiences, catharsis, and games of chance. Erdmann (10) and Steffgen, Fröhling, and Schwenkmezger (25) report sound psychometric properties for this scale. This questionnaire consists of five subscales, which evaluate five types of exercise-specific attitudes: training/competition (14 items), beauty/elegance (12 items), danger/risk (10 items), social contact (10 items), and health/fitness (10 items). The item response options are dichotomous, 'agree' or 'do not agree'. Total sums scores were calculated for each subscale, whereby higher scores indicated more positive attitudes. For this sample, each subscale of the questionnaire had adequate internal consistency (Cronbach's $\alpha \geq .75$).

Current Levels of Physical Activity and Exercise: According to Sallis and Saelens (24), the validity of a quantitative measurement of physical activities by self-focused attention is restricted. Due to economic reasons, an objective measurement of the activity level by using instrument-based methods could not be realized. Participants' current levels of recreational physical activity and exercise were assessed with a one item measure, "What kind of sport and exercise (apart from Physical Education at school) do you currently do?", with two response options: [1] Currently, I don't participate in sport and exercise, [2] Currently, I participate in sport and exercise. Additionally, participants' history of sport club membership was assessed with one item, "Are you currently, or have you ever been, a member of a sport club?", with three response options: [1] never, [2] in the past, [3] at present, an active member. Two dichotomous variables [1] physical activity (physically active or not physically active at the moment), and [2] status of sport club membership (at present an active member or not an active member), were generated from the answers.

Body Weight and Height: Participants' body weight and height was also measured, fully clothed without shoes. Weight was measured on a digital scale (Soehnle, model Alpha Niro). Height was measured using the mechanic measure body meter 206 (seca Vogel & Halke GmbH & Co). As participants were clothed during the measurement of weight, 1.5 kilograms was deducted from each person's body weight.

Procedure

School participants completed the questionnaires within a classroom setting. Participants from the obesity treatment sample completed the questionnaires at the beginning of their non-stationary training program. All measures were completed under the supervision of an investigator. Directly after completion of the questionnaire, participants' weight and height were measured individually in a separate room.

		Healthy-weight school adolescents (n=289)	Obese school adolescents (n=46)	Non-stationary therapy group (n=16)
Gender	female	145 (50%)	27 (59%)	10 (63%)
	male	144 (50%)	19 (41%)	6 (38%)
Age (M ± SD) in years		13.82 ± 1.34	14.26 ± 0.98	14.06 ± 1.44
Attended school	lower secondary school	38 (13%)	22 (48%)	1 (6%)
	comprehensive school	69 (24%)	2 (4%)	5 (31%)
	secondary school	99 (34%)	16 (35%)	2 (13%)
	academic high school	83 (29%)	6 (13%)	4 (25%)
	special school	-	-	2 (13%)
	not specified	-	-	2 (13%)
Physical activity	active	251 (87%)	40 (87%)	13 (81%)
	not active	38 (13%)	6 (13%)	2 (13%)
	not specified	-	-	1 (6%)
Status of sports club membership	active member	107 (43%) ^a	11 (28%)	4 (29%)
	no active member	140 (56%)	29 (73%)	10 (71%)
	not specified	4 (26%)	-	-

Table 1: Comparison of distributions of biographic variables and characteristics of sport participation in the subgroups. ^aData refer to the subgroup of physical active participants.

RESULTS

Data Preparation and Preliminary Analyses

Participants' were categorised by body weight (healthy-weight, overweight and obese weight), using the German BMI percentile method for children and adolescents aged under 18 years (18). To explore differences in groups, the current study was primarily interested in comparing the attitudes of obese (BMI > 97th percentile) and healthy-weight (BMI ≤ 90th percentile) adolescents only. Consequently, 60 of the school adolescents, who were in the overweight range (BMI > 90 and ≤ 97 percentile), were excluded from future analyses. Three subgroups were included in the analyses; healthy-weight school adolescents (n=289; BMI, M=19.53, SD=2.35), obese school adolescents (n=46; BMI, M=31.11, SD=4.31), and obese adolescents from the non-stationary therapy group (n=16; BMI, M=33.28, SD=5.05). Table 1 describes the demographic characteristics of the subgroups.

As there were an unequal number of participants in the obese and healthy-weight range categories, and a lack of normal distribution in some variables, nonparametric analyses were performed. Specifically, the distributions of gender, age, attended school, physical activity levels, and status of sport club membership were compared for the obese and healthy-weight range categories.

Demographic Variables

Chi-square independence tests with Monte Carlo-estimation showed no significant differences between the obese and healthy-weight categories for gender (χ^2 (2, N=351)=1.916, p=.408), status of sport club membership (χ^2 (2, N=351)=4.460, p=.117), and physical activity (χ^2 (2, N=350)=.001, p=1.000). However, chi-square analyses detected significant differences between the weight categories for attended school (χ^2 (8, N=351) = 89.594, p<.001). To explore this further, Kruskal-Wallis-Tests were conducted to determine if there were systematic differences in the attitudes towards physical activity and exercise between participants from different schools. This analysis detected a significant difference between the schools for

the beauty/elegance subscale (χ^2 (3, N=335) = 37.458, p<.001) only. Finally, an inspection of the distribution of age between weight categories with a Kruskal-Wallis-Test, detected a significantly different age structure (χ^2 (2, N=351)=6.255, p=.044) between the weight categories. Due to the differences in age structure, the correlation between age and attitude scores was examined. A small, but significant, inverse correlation (r=-.21; p<.001) between age and attitude scores on the training/competition subscale only was detected.

Physical Activity and Exercise Attitudes for Obese and Healthy-weight Range Adolescents

To compare obese and healthy-weight range adolescents' attitudes towards physical activity and exercise, Mann-Whitney-U-Tests were conducted. A significant difference between the healthy-weight and obese school adolescents was found on the training/competition subscale (n₁=289, n₂=46; Mann-Whitney-U=5413.500, p=.042), whereby healthy-weight adolescents had more positive attitudes. There were, however, no significant differences in training/competition attitudes between healthy-weight school adolescents and obese adolescents in treatment, or between the obese school and treatment subgroups. Whilst a trend towards a significant difference between healthy-weight and obese school students was detected on the danger/risk subscale (n₁=289, n₂=46; Mann-Whitney-U=5585.500, p=.080), there were no significant differences on the remaining subscales.

Influence of Current Levels of Physical Activity and Exercise and Sport Club Membership on Attitudes

Separate Mann-Whitney-U-Tests for the three subgroups (healthy-weight school students, obese school students, obese treatment adolescents) were performed to detect if differences in exercise-related attitudes were dependent on current levels of physical activity and exercise and sport club membership.

Physical Activity and Exercise. For healthy-weight range school students, those who engaged in exercise during leisure time had a more positive attitude towards training/competition (n₁=251,

$n_2=38$; $U=2559.000$, $p<.001$) and social contact ($n_1=251$, $n_2=38$; $U=3498.000$, $p=.008$), in comparison to those who did not engage in leisure-time exercise. Similar results were revealed for the obese school student subgroup on the training/competition subscale ($n_1=40$, $n_2=6$; $U=47.000$, $p=.015$), and a trend towards significance on the social contact subscale ($n_1=40$, $n_2=6$; $U=61.500$, $p=.055$), indicating more positive attitudes if they were engaged in leisure time activities. No differences occurred in the obese subgroup receiving therapy.

Sport Club Membership. For adolescents in the healthy-weight range, active sports club members scored more positively on the training/competition subscale ($n_1=140$, $n_2=107$; $U=4212.000$, $p<.001$). No differences were revealed for the obese student subgroup. Within the sample of obese adolescents receiving treatment, adolescents who were active members of a sports club scored higher on the social contact subscale ($n_1=10$, $n_2=4$; $U=2.500$, $p=.008$), compared to the inactive adolescents.

DISCUSSION

As obese adolescents are more likely to have poor motor abilities than healthy-weight range adolescents (12,17), the obese adolescents may have been excluded or criticised during sporting competitions (11). Therefore, the less positive attitudes towards training and competition held by obese adolescents in this study may have been developed as a result of recurrent negative experiences during previous exercise with peers (28). The results of this study suggest that intensive training and competition between participants offer a lower incentive for obese adolescents for sport participation than for healthy-weight peers. With regard to the trend toward significant differences in groups, this could maybe apply also for risky sporting activities. The disadvantage of obese adolescents regarding their motor ability is especially high reflected in common sporting activities with healthy-weight peers, for example by having physical education in school. Therefore, it is recommended for school sport activities to moderately use competition and performance situations and to compensate disadvantages of obese students by supporting those strategic and pedagogical activities (3). In the therapy of obesity a contribution regarding to effectiveness and sustainability of sport interventions can be achieved by highlighting health and social incentives along with participation in sports especially at the beginning of the therapy. During therapy is should be complemented by communicating a positive attitude towards intensive physical exercise and competitions.

The trend towards a significant difference in attitudes between healthy-weight range and obese students on the danger/risk subscale may show that obese adolescents prefer less risky situations during physical activity and exercise than their healthy-weight range counterparts. This result could be explained by research which indicates that obese adolescents may be at a higher risk for injury due to having a higher body weight (1).

The results also indicate that participation in obesity treatment is not associated with more positive attitudes towards physical activity and exercise for obese adolescents. This is reflected in the total difference of the mean ranks on the training/competition and danger/risk subscales, whereby the differences in attitudinal scores for healthy-weight range students and obese treatment adolescents was almost equal to the difference between healthy-weight

range and obese students. This result can be explained by the relative stability and limited influence on the measured construct (28). An improvement of attitude towards physical and sporting activity of adolescents can possibly be proved only at a later stage of therapy, as reported by Christodoulos and colleagues (5) following a one-year school based health education program. Furthermore, the results were not significant for the comparison of healthy-weight range students and therapy participants. This may be either explained by the therapy participants' higher sensitivity to the object of this study in consequence of the decision for participating in a therapy program or due to the varying sample size. It has also to be considered, that the measuring instrument in this study mainly determines explicit attitudes towards physical activity, which are prone to the impact of social acceptability and proved to be independent from implicit attitudes in an adult population by Hyde et al. (14). Although, Creynest and colleagues (6) determined no differences in the characteristics of implicit attitudes towards physical activity with regard to healthy-weight and obese children, the authors suggest that further research efforts are necessary.

The development of positive attitudes towards exercise is seen as a major goal of activities designed to promote long-term exercise and movement improvement (8). Therefore, the question remains whether interventions tailored to increase the engagement in sports, for example within the scope of multi-modal obesity treatment programs, do have the ability to create positive attitudes towards physical activity and exercise.

This study also found no difference between obese and healthy-weight adolescents concerning current levels of exercise participation. Similar results were also reported by Levin and colleagues (20). It was found that exercise participation - for the healthy-weight range and obese students - was associated with more positive attitudes towards training/competition and social contact. Within the non-stationary obesity participants, the attitudes towards physical activity and exercise participation were not dependent on current levels of sport participation.

Furthermore, the current study found inconsistent results concerning participation in organised membership sport. Of the active sports club members, only the healthy-weight range adolescents reported a stronger preference for training- and competition-orientated sports. Whereas for participants in the treatment subgroup, social contact during physical activity and exercise was valued higher by participants who were sport club members.

The inclusion of obese adolescents from both the school and a non-stationary obesity samples was a strength of this study. In contrast to the findings of Braet et al. (2), these results do not indicate a higher psychosocial stress referring to sport and exercise participation in the clinical subgroup of obese compared to the non-clinical subgroup.

It is important to note that the results of this study may have been influenced by the large differences in group size, which limited the statistical analysis of the data. In addition, the method used to measure the current levels of physical activity and exercise is limited to one item in a questionnaire. However, more research is needed to explore the association between exercise-related attitudes and the extent/intensity of physical and sportive activity. The inclusion of objective methods (e.g. accelerometers, heart rate measurements) would strengthen this kind of studies.

Conflict of interest: The authors have no conflict of interest.

REFERENCES

1. **BAZELMANS C, COPPIETERS Y, GODIN I, PARENT F, BERGHMANS L, DRAMAIX M, LEVÉQUE A.** Is obesity associated with injuries among young people? *Eur J Epidemiol.* 2004;19:1037-1042. doi:10.1007/s10654-004-0158-5
2. **BRAET C, MERVIELDE I, VANDEREYCKEN W.** Psychological aspects of childhood obesity: a controlled study in a clinical and nonclinical sample. *J Pediatr Psychol.* 1997; 22:59-71. doi:10.1093/jpepsy/22.1.59
3. **BRODTMANN D.** Adipöse Kinder und Jugendliche im Schulsport. Sportpädagogische und sportdidaktische Perspektiven. *Sportpädagogik* 2005; 29(2): 42-45.
4. **CHEN-STUTE A, PINNOW M, KOPCZYNSKI S, HUTTNER A, HAUNER H.** T.O.M. (Therapie der Obesitas mit Motivation) - Ein dreijähriges, ambulantes Therapieprogramm für adipöse Kinder und Jugendliche. *Adipositas.* 2009;2: 27-32.
5. **CHRISTODOULOS AD, DOUDA HT, POLYKRATIS M, TOKMAKIDIS SP.** Attitudes towards exercise and physical activity behaviours in Greek schoolchildren after a year long health education intervention. *Br J Sports Med.* 2006; 40: 367-371.
6. **CREYNES M, CROMBEZA G, DE HOUWERA J, DEFORCHE B, TANGHE A, DE BOURDEAUDHUIJ I.** Explicit and implicit attitudes towards food and physical activity in childhood obesity. *Behav Res Ther.* 2005; 43:1111-1120. doi:10.1016/j.brat.2004.07.007
7. **DEFORCHE BI, BOURDEAUDHUIJ IM, TANGHE AP.** Attitude toward physical activity in normal-weight, overweight and obese adolescents. *J Adolesc Health.* 2006; 38:560-568. doi:10.1016/j.jadohealth.2005.01.015
8. **DIGELIDIS N, PAPAIOANNOU A, LAPARIDIS K, CHRISTODOULIDIS T.** A one-year intervention in 7th grade physical education classes aiming to change motivational climate and attitudes towards exercise. *Psychol Sport Exerc.* 2003; 4:195-210. doi:10.1016/S1469-0292(02)00002-X
9. **EAGLY AH, CHAIKEN S.** Attitude structure and function, in: Gilbert D, Fiske ST, Lindzey G (Eds.): *Handbook of social psychology.* McGraw-Hill, New York, 1998, 323-390.
10. **ERDMANN R.** Einstellung zu Sport und zu sportlicher Aktivität (ESA). Eine Modifikation der ATPA-D-Skalen als ökonomisches Messinstrument für Gruppenvergleiche, in: Decker W, Lämmer W (Eds.): *Köln Beiträge zur Sportwissenschaft.* Richarz, St. Augustin, 1982, 127-146.
11. **FRELUT ML, FLODMARK CE.** The obese adolescent, in: Burniat W, Cole TJ, Lissau I, Poskitt E (Eds.): *Child and adolescent obesity.* Cambridge University Press, Cambridge UK, 2002, 145-170.
12. **GRAF C, KOCH B, KRETSCHMANN-KANDEL E, FALKOWSKI G, CHRIST H, COBURGER S, LEHMACHER W, BJARNASON-WEHRENS B, PLATEN P, TOKARSKI W, PREDEL H-G, DORDEL S.** Correlation between BMI, leisure habits and motor abilities in childhood (CHILT-project). *Int J Obes.* 2004;28:22-26. doi:10.1038/sj.ijo.0802428
13. **HAGGER M, CALE L, ALMOND L.** The importance of children's attitudes towards physical activity. *Kineziologija.* 1995; 27:12-16.
14. **HYDE AL, DOERKSEN SE, RIBEIRO NF, CONROY DE.** The independence of implicit and explicit attitudes toward physical activity: introspective access and attitudinal concordance. *Psychol Sport Exerc.* 2010;11:387-393. doi:10.1016/j.psychsport.2010.04.008
15. **JIMÉNEZ-PAVÓN D, KELLY J, REILLY JJ.** Associations between objectively measured habitual physical activity and adiposity in children and adolescents: Systematic review. *Int J Pediatr Obes.* 2010; 5:3-18.
16. **KENYON GS.** A conceptual model for characterizing physical activity. *Res Q Exerc Sport.* 1968;39:96-105.
17. **KORSTEN-RECK U, KASPAR T, KORSTEN K, KROMEYER-HAUSCHILD K, BÖS K, BERG A, DICKHUTH HH.** Motor Abilities and Aerobic Fitness of Obese Children. *Int J Sports Med.* 2007; 9:762-767. doi:10.1055/s-2007-964968
18. **KROMEYER-HAUSCHILD K.** Definition, Anthropometrie und deutsche Referenzwerte für BMI, in: Wabitsch M, Zwiauer, Hebebrand J, Kiess W (Eds.): *Adipositas bei Kindern und Jugendlichen.* Springer, Berlin, 2005, 3-15.
19. **KURTH B-M, SCHAFFRATH ROSARIO A.** Übergewicht und Adipositas bei Kindern und Jugendlichen in Deutschland. *Bundesgesundheitsblatt.* 2010; 53:643-652.
20. **LEVIN S, LOWRY R, BROWN DR, DIETZ WH.** Physical activity and body mass index among US adolescents. *Arch Pediatr Adolesc Med.* 2003;157:816-820. doi:10.1001/archpedi.157.8.816
21. **MARINOV B, KOSTIANEV S, TURNOVSKA T.** Ventilatory efficiency and rate of perceived exertion in obese and non-obese children performing standardized exercise. *Clin Physiol Funct Imaging.* 2002; 22:254-260. doi:10.1046/j.1475-097X.2002.00427.x
22. **ROBBINS LB, PENDER NJ, RONIS DL, KAZANIS AS, PIS MB.** Physical activity, self-efficacy, and perceived exertion among adolescents. *Res Nurs Health.* 2004; 27:435-446. doi:10.1002/nur.20042
23. **SALLIS JF, FLOYD MF, RODRÍGUEZ DA, SAELENS BE.** Role of built environments in physical activity, obesity, and cardiovascular disease. *Circulation.* 2012; 125:729-737. doi:10.1161/CIRCULATIONAHA.110.969022
24. **SALLIS JF, SAELENS BE:** Assessment of physical activity by self-report: Status, limitations, and future directions. *Res Q Exerc Sport.* 2000; 71: 1-14.
25. **STEFFGEN G, FRÖHLING R, SCHWENKMEZGER P.** Motive sportlicher Aktivität. Psychometrische Untersuchungen einer Kurzform der ATPA-D-Skalen. *Sportwissenschaft.* 2000; 30:408-421.
26. **STORCH EA, MILSOM VA, DE BRAGANZA N, LEWIN AB, GEFFKEN GR, SILVERSTEIN JH.** Peer victimization, psychosocial adjustment, and physical activity in overweight and at-risk-for-overweight youth. *J Pediatr Psychol.* 2007; 32:80-89. doi:10.1093/jpepsy/32.1.80
27. **TREMBLAY MS, WILLMS JD.** Is the Canadian childhood obesity epidemic related to physical inactivity? *Int J Obes.* 2003; 27:1100-1105. doi:10.1038/sj.ijo.0802376
28. **TRIANDIS HC.** *Attitude and attitude change.* Wiley, New York, 1975.

Corresponding Address:
Prof. Dr. Michael Kellmann
Ruhr-University Bochum
Faculty of Sport Science
Gesundheitscampus Nord 10
44801 Bochum
E-Mail: Michael.Kellmann@rub.de