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Summary

SUMMARY

The aim of this thesis was to describe: 1) the accuracy of self-reported weight and height of children at the general practitioner; 2) the associations between childhood weight status and its medical consequences such as the frequency of musculoskeletal and respiratory consultations at the general practitioner; 3) the effect of a multidisciplinary intervention program for children with obesity on different health outcomes; 4) the physical activity behavior of normal-weight children and children with overweight.

PART I:

In **chapter 2**, the aim was to investigate the differences between self-reported weight and -height, and measured weight and -height for children with underweight, -normal-weight and -overweight in a general practice setting. Data from the DOERAK database was used to investigate these differences. The DOERAK database was set up to investigate potential differences between normal-weight children and children with overweight in general practice and consisted of 733 children aged 2-18 years. Means of reported and measured weight and height were compared using the paired T-test. Of the 715 included children, 17.5% were defined as underweight, 63.2% as normal-weight and 19.3% as overweight according to measured weight and height. In the age group 2-8 years, parents of children with underweight reported a significantly higher weight than measured weight (mean difference (MD) 0.32kg; 95%CI 0.02, 0.62), while parents of children with overweight reported a significantly lower weight (MD -1.08kg; 95%CI -1.77, -0.39). In the age group 9-17 years, normal-weight children (MD -0.51kg; 95%CI -0.79, -0.23) and children with overweight (MD -1.28kg; 95%CI -2.08, -0.47) reported a significantly lower weight than measured weight. Therefore, general practitioners cannot rely on self-reported weight and height measures from children and their parents, and should measure children themselves to prevent any misclassification of weight status from happening.

PART II:

The review in **chapter 3** examined the differences in bone mineral density (BMD) between children of normal-weight and children with overweight or obesity. Medline (OVID), Embase, Cochrane, Web of Science (WoS), Cinahl ebSCO, Pubmed publisher and Google scholar were systematically reviewed for articles providing data on differences in BMD between children with normal-weight and -overweight and/or children with normal-weight and -obesity. Twenty-seven studies, with a total of 5958 children, were included.

There was moderate and high quality of evidence that children with overweight (MD 213 grams; 95%CI 166, 261) and children with obesity (MD 329 grams; 95%CI 229, 430) have a significantly higher whole body bone mineral content than normal-weight children. Similar results were found for whole body bone mineral density. Sensitivity analysis showed the association was stronger in girls. In conclusion, children with overweight and -obesity have a higher BMD than normal-weight children, however since only one study with a longitudinal design was included in this review, the long-term impact of childhood overweight and obesity on bone health at adulthood remains unclear.

Chapter 4 studied the association between weight status and the frequency and type of musculoskeletal consultations at the general practice during a two-year follow up. Similar to chapter 2, data from the DOERAK database were used. Poisson regression and logistic regression analyses were applied to test whether weight status was associated with the presence, the frequency and type of musculoskeletal consultations at the general practice. Multivariable analysis was used to test for different predictors for musculoskeletal consultations during the two-year follow up. Children with overweight consulted the general practitioner in general significantly more frequent during the 2-year follow up than normal-weight children (mean 7.3 (5.7) vs 6.7 (5.4), odds ratio (OR) 1.09; 95%CI 1.01-1.18). No significant difference was seen in the number of normal-weight children compared to children with overweight consulting their general practitioner for musculoskeletal complaints (OR 1.20; 95%CI 0.86 – 1.68). Additionally, no significant difference between normal-weight children and children with overweight was seen for the number of consultations for further specified musculoskeletal disorders. Thus, children with overweight do consult the general practitioner more often than normal-weight children, but not for musculoskeletal complaints.

In **chapter 5** the associations between weight status and the frequency and type of respiratory consultations were investigated. Data from the DOERAK database was used. Logistic regression analyses and negative binominal regression analyses were applied to test the associations between weight status and the presence, the frequency and the type of respiratory consultations during a two year follow-up. Respiratory consultations were not more prevalent in children aged 2-18 years with underweight compared to normal-weight children aged 2-18 (OR 0.87; 95%CI 0.64-1.10). Respiratory consultations were also not more prevalent in children aged 2-18 years with overweight compared to normal-weight children (OR 1.33; 95%CI 0.99-1.77). Though, children with overweight aged 12-18 years had significantly more respiratory consultations at the general practice than normal-weight children aged 12-18 years (OR 2.14; 95%CI 1.14-4.01). Children with overweight aged 12-18 year also had more asthma-like consultations (OR 3.94; 95%CI 1.20-12.88), and more respiratory allergy related consultations (OR 3.14; 95%CI 1.25-7.86) than normal-weight children aged 12-18 years. In younger children, no associations were found between weight status and respiratory consultations. Thus, children with

overweight aged 12-18 years consult the general practitioner more often for respiratory consultations, asthma-like consultations and respiratory allergy related consultation than their normal-weight peers.

PART III:

In **chapter 6**, a study is presented that aimed to investigate the effects of a multidisciplinary intervention program, for children with obesity in socially deprived areas, on blood pressure and cardiorespiratory fitness.

Children with obesity who signed-up for the 12-week intervention program 'Kids4Fit' were eligible to participate in this study. After signing-up for Kids4Fit, children were placed on a waiting list, which was used as a control period, until there was a group of 8-12 children signed-up to start the intervention. Cardiorespiratory fitness was assessed by using the shuttle-run-test (SRT). Blood pressure measurements and SRT were performed at baseline, at the start of the intervention, at the end of intervention and at 52 weeks after the start of the intervention. The effect of Kids4Fit on blood pressure and on SRT scores were analyzed using mixed models and effectplots. A total of 154 children were included with a mean age of 8.5 years (standard deviation 1.8). Effect plots showed an initial significant increase of the SRT-scores but this effect diluted after the intervention. No significant change was seen in systolic blood pressure percentiles at 52 weeks after start of the Kids4Fit intervention (β 0.08; 95%CI -0.06, 0.22). Diastolic blood pressure percentiles increased significantly over time (β 0.20; 95%CI 0.08, 0.31). Thus, a local multidisciplinary intervention program improves cardiorespiratory fitness, but the positive health effects of the intervention dilute after the intervention.

Chapter 7 examined the levels of physical activity in normal-weight children and children with overweight, and the accuracy of self-reported physical activity compared to objectively measured physical activity. This study used data from the DOERAK database, in which a subgroup ($n=65$) of the participants wore an ActiGraph for one week to objectively measure physical activity. During the same week, participants filled out a diary on physical activity. Linear mixed models and GEE were used to test for differences in objectively measured physical activity between children with normal-weight and-overweight. Generalized estimating equations (GEE) were applied to test for differences between children with normal-weight and-overweight for reported time spent on watching TV, using the computer, playtime outside and playing sports. Children with overweight spent significantly less percentage time per day in sedentary behavior (β -1.65; 95%CI -3.12, -0.18), significantly more percentage time in light to moderate physical activity (β 1.48; 95%CI 0.07, 2.89), and significantly more percentage time in moderate to vigorous physical activity (β 0.45; 95%CI 0.02, 0.87) than normal-weight children. No significant

differences were seen between normal-weight children and children with overweight for reported time spent on watching TV, using the computer, playtime outside and playing sports. Self-reported values of physical activity do not correlate well with objectively measured values. Thus, children with overweight are not less physically active than normal-weight children. Furthermore, self-reported values of physical activity of children with normal-weight and with overweight should be handled with care.

Finally, in **chapter 8** the main results are discussed in a broader perspective, and implications for general practice and suggestions for future research are given.