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# 'Healthy children in sound communities' (HCSC/gkgk)—a Dutch–German community-based network project to counteract obesity and physical inactivity

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**Background.** In 12 municipalities at the German-Dutch border an integrated approach of a multi-component intervention programme (physical activity, nutrition, public health, improvement of the physical environment) to enhance an active lifestyle has been implemented in 39 primary schools for a 4-year longitudinal intervention and evaluation study.

**Objective.** A weekly lesson plan, including 3 hours of health enhanced physical education and two additional hours of physical activities offered by sport clubs to balance motor deficits and to reduce overweight and obesity was implemented. Furthermore, another hour of cross-curricular education of health and nutrition education is part of the school curriculum. To achieve 60 to 90 minutes of daily physical activities for 6- to 10-year-old pupils active commuting to school has become a part of school life.

**Methods.** A physical fitness and motor development test is applied each school year including BMI measurements as a part of a socio-ecological concept. Intrapersonal developments of the pupils are measured by different questionnaires focusing on the individual social context of physical activity, nutrition habits and time allocation for electronic media.

**Results.** Original values of Motor Ability tests show significant increase in endurance, coordination, velocity and force tasks. Also first changes for BMI distribution are explored in only one year intervention.

**Conclusion.** First results indicate the possibility to counteract obesity and to increase levels of physical fitness and motor development by a multi-component progamme and a multi-sector approach of intervention. The longitudinal design of the study allows having a look on long-term effects.

**Keywords.** Health-enhanced PE and PA, nutrition education.



## Introduction

There is general agreement across different academic disciplines that the problem of overweight and obesity can be simply explained by the fact that calorie intake and calorie expenditure do not balance. But against the simplicity of this explanation, we have the difficulty of stating unequivocally which of the many possible factors together contribute to the causes, manifestations and consequences of overweight and obesity and by which mutual constellations and influences they are related. Individual factors are accorded different weightings by different specialist disciplines (e.g. genetic medicine, cardiology, epidemiology, food science, exercise and sport science, educational, social and environmental science) but these factors never occur in for an individual and within a setting of his/her livehood in isolation. Anyone supporting an interdisciplinary approach to explain and counteract obesity has to distinguish at least four groups of factors: (i) intra-individual body and health development; (ii) interpersonal influence on bodily development, nutrition and physical

activity; (iii) stakeholders influences on economical, social and educational strata and (iv) environmental correlates and determinants by different policy making in sectors of livehood.

Therefore, this study does not focus on a classical biomedical paradigm of treatment and intervention. These groups of four factors can be further differentiated to give a certain number of significant individual factors in each of the four groups. For our project, it is crucial that these four groups be taken together as a measure of a coherent intervention strategy, which avoids a single approach or only one group of intra-individual or interpersonal or environmental factors advised by some previous review studies.[1–5]

The research interest of this study is not focussed to identify the most or less important predictor but to achieve an evidence-based outcome of decreased obesity body mass index (BMI), an increase of basic motor abilities and behavioural changes to a less sedentary and more active lifestysle of primary schoolchildren in their age of 6 up to 10 years (4 years intervention study).

An integrated approach to promote an active lifestyle must address all four groups of factors, which consequently leads to a transdisciplinary intervention strategy within a socioecological context for individual development.[6] A socioecological model of transdiciplinary interventions must consider all children's important social settings (home, school, leisure and sports clubs and informal community spaces) as well as different stakeholders as partners for primary education development and health care within a common network at local community level.[7–9]

The healthy children in sound communities (HCSC)/gkgk project includes at least four criteria:

1. Transdisciplinary intervention approach
2. Comprehensive multi-setting strategy
3. Cross-border implementation at local community level in the Netherlands and Germany
4. Daily physical activities of at least 60 up to 90 minutes of health-enhanced physical education and extracurricular physical activities combined with a cross-curricular health and nutrition education.

## Method

*Foundation of front and back offices, community moderator to enhance networking*

Different sector stakeholders found a 'local network of active living', which is labelled in German and Dutch language as 'Runder Tisch', 'ronde tafel'. In each of the 12 German and Dutch municipalities of the HCSC/gkgk project a 'Round table for active living' was established before the project started (and in 2006 already in Velen in the pilot study).[10] These local tables represent the different 'front offices' for the project, which interact with a 'back office'. The back office is responsible for all front offices in terms of funding and general steering of the project on a common regional cross-border level. At each municipality, a so called 'municipality moderator' is hired as a modern type of a public health manager who manages the needs and demands of each stakeholder of the front office in order to implement the different parts of the intervention programme in coordination with the local schools and sport clubs as well as with and between the different municipality offices which are responsible for education, health, social work and physical activities. The local municipality moderator serves for the local network of the stakeholders to link all partners and to enhance further cooperation between the partners for the implementation of the tailored intervention programme. The municipality moderator works together with one scientific staff member of the Willibald Gebhardt Research Institute (WGI), which manages the back office and gives applied support by its staff members for the intervention programme at each municipality.

*Intervention programme and measurements*

The complex of measures provides for curricular, co-curricular and extracurricular activities (integration). Moreover, the concept of integration will also be pursued within individual curricular and extracurricular activities. For example, one 3 hour period of physical education (with the accent on the promotion of health) coordinated with one interdisciplinary cross-curricular hour from the social studies course (body—exercis—diet—media). At the beginning of the project, all the first-year ('or groep 3') students involved are given a basic motor diagnosis that verifies their age-appropriate learning development and their weight status (BMI). Subsequently, they all receive individually tailored support during the third school sport period. In addition, on two afternoons a week, all pupils are offered further differentiated courses provided by local sports clubs in order to continue to encourage individuals' exercise skills and healthy behaviour.

The basic motor test and BMI measurement are repeated in each subsequent school year and the results are recorded as an individual learning development log and reported to parents at special parent and teacher meetings (PTA) meetings. Teachers in charge of project classes are also permitted to see the health and motor development profile of the student body. Health promotion activities within physical education lessons are then planned on the basis of these results.

*Physical education*

Ordinary physical education in gkgk schools is allotted 3 hours/week in Germany and 2 hours/week in the Netherlands:

| Time | Monday | Tuesday | Wednesday | Thursday | Friday |
|---|---|---|---|---|---|
| Active Commuting | Walking Bus | | | | |
| 08:05 hrs | | | | | PE: seperated sub-groups to balance special needs |
| 08:55 hrs | PE: basic motor skills development | | | | |
| 09:40 hrs | BREAK: healthy breakfast, active school | | | | |
| 10:05 hrs | | | | Science: nutrition, my body, my PA | |
| 10:55 hrs | | | PE: basic skills and techniques in games | | |
| 11:40 hrs | BREAK: healthy breakfast, active school | | | | |
| 11:55 hrs | | | | | |
| 12:40 hrs | | | | | |
| 13:20 hrs | | | | | |
| Active Commuting | Walking Bus | | | | |
| Afternoon | | PA: Sports Club | | PA: Sports Club | |

FIGURE 1 *gkgk lesson plan*

1. A first basic physical education lesson for all children in the class (training of basic motor skills, elementary physical education, promoting flexibility, coordination, endurance and strength).
2. A second basic sports lesson involving different types of games to extend these basic motor skills in games and sports.
3. A differentiated physical education lesson for all the students, given by additional teaching staff in small groups and separate rooms according to the children's individual development profile (BMI and motor development). In the Netherlands, this new differentiated third lesson will be introduced at the local project schools.

*General and social studies*

The curriculum for general and social studies in North Rhine-Westphalia includes 1 hour/week on the topics body, diet, lifestyle and health promotion, highlighting their joint contribution to healthy development.

In order to promote more effectively and more directly the raising of healthy children, our joint health project not only needs to monitor the motor and physical development of each of the participating children, we also need to learn more about those lifestyle components that either encourage or hinder that development, particularly those factors that influence their exercise habits, eating habits and media consumption since all three of these have a lasting effect on the lifestyle. From the second school year, we therefore ask the children and their parents to each complete a questionnaire including questions about these three factors and their results are then used to interpret the motor tests.

*Extracurricular school sport*

For the gkgk project, each school is cooperating with at least one sports club in the municipality. Thanks to this cooperation; it is possible to offer all the students in the project two additional afternoon classes of movement and exercise to reinforce and broaden the improvement in their health and to supplement the three PE lessons (see Fig. 1) they receive at school, specifically in order to bring their daily exercise periods up to 60 or 90 minutes.

*Active school route and sports during break times*

The 'walking bus' was introduced to provide an active school route between school and home. Walking bus means that children walk to school along safe sidewalks accompanied by individual parents or other responsible persons. On this route, there are 'stops' near to the children's homes at which the walking bus will halt at prearranged times so that the individual child from each residential area can join it.

*Healthy eating and food preparation*

As a part of the general and social studies class, and as additional events in the afternoon and early evening, there will also be separate and joint cookery courses and 'school fruit events' for the schoolchildren and their parents. Similarly, during break periods, many gkgk schools organize and prepare a 'healthy breakfast' together with teachers. Most of the gkgk schools

TABLE 1 *Motordevelopment of the German and Dutch cohort*

| | Sit-ups, *n* | Push-up, *n* | Sit and reach, cm | 20-m sprint, seconds | Standing broad jump, cm | Rapid alternation, *n* | Balance backwards, *n* | 6-minute run, m | BMI, *n* | Age, years |
|---|---|---|---|---|---|---|---|---|---|---|
| Germany, $N = 261$ | | | | | | | | | | |
| t1 | 14.0 | 12.0 | 3.5 | 4.6 | 107.9 | 23.8 | 24.1 | 876.1 | 16.5 | 7.2 |
| t2 | 17.6 | 14.3 | 3.0 | 4.4 | 111.3 | 30.4 | 27.0 | 944.4 | 16.7 | 8.2 |
| *P* | 0.001 | 0.001 | 0.105 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | |
| $\eta^2$ | 0.329 | 0.214 | | 0.414 | 0.041 | 0.516 | 0.174 | 0.307 | 0.051 | |
| The Netherlands, $N = 296$ | | | | | | | | | | |
| t1 | 15.0 | 10.2 | 4.6 | 4.8 | 103.9 | 20.7 | 22.4 | 873.8 | 16.3 | 7.0 |
| t2 | 17.4 | 12.2 | 2.7 | 4.6 | 111.5 | 26.4 | 26.6 | 914.4 | 16.6 | 7.8 |
| *P* | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | |
| $\eta^2$ | 0.224 | 0.137 | 0.066 | 0.126 | 0.159 | 0.442 | 0.148 | 0.085 | 0.049 | |

in North Rhine-Westphalia (NRW) take part in the EU's 'school fruit project'.

All these measures are combined to produce an ideal gkgk timetable as exemplified below. The local networks incorporating teachers, community moderators and other partners are all working towards the implementation of this weekly timetable in schools (Fig. 1).

*Further education and teaching materials*

All teaching elements and objectives to achieve are parts of a special further education and training programme for teachers (PE, nutrition and health) and coaches who are involved to conduct the intervention programme. Further education and training courses are given by experts on a local and regional level, which include also cross-border clinics and seminars. The homepage of the project (www.gk-gk.eu) provides a special download centre in German and Dutch language where special designed lesson plans for health-enhanced PE; PA education are available for the gkgk classes.

*Evaluation*

The first and core actor level is the participating children and their three intrapersonal behaviour areas: physical and health development (physical fitness) plus motor skills, including BMI; the qualitative aspects of their active or passive lifestyle (quality of life) that cover the social context of their leisure behaviour (exercise, nutrition and media) including their mental and emotional well-being and aspects of their social integration into peer groups together with indicators of group climate, group cohesion and physical self-concept (social benefits).

At the second actor level, we have the interpersonal relationships in the children's central life-worlds, i.e. the influence and interaction of children with their parents, teachers, trainers or coaches and peers.

At the third level, we see their physical-material life-world, i.e. the existing or constructed conditions of their residential area or their residential conditions, the infrastructure of schools and school grounds and the structural characteristics of the participating sports clubs.

Finally, the level of local political control of the children's life-worlds and living conditions: the town's education, health and sports policies, socio-spatial planning and development processes for their residential neighbourhoods, the available sports facilities for their physical activity and the means of transporting them to and from these life-worlds (schools, clubs, etc.) in the form of more or less motorized and non-motorized segments of their daily physical activity.

This paper refers to the core actor level and focuses on the outcome of physical and health development after the first school year of intervention.

TABLE 2 *Comparison between Dutch and German results (t1 and t2)*

| Germany, $N = 261$; The Netherlands, $N = 296$ | Sit-ups, *n* | Push-up, *n* | Sit and reach, cm | 20-m sprint, seconds | Standing broad jump, cm | Rapid alternation, *n* | Balance backwards, *n* | 6-minute run, m | BMI, *n* | Age, years |
|---|---|---|---|---|---|---|---|---|---|---|
| t1 | –2.038 | 5.548 | –2.554 | –3.701 | 2.465 | 5.303 | 2.200 | 0.230 | 1.096 | 5.837 |
| degrees of freedom | 555 | 555 | 555 | 555 | 555 | 555 | 555 | 555 | 555 | 555 |
| Significance | 0.042 | 0.000 | 0.011 | 0.000 | 0.014 | 0.000 | 0.028 | n.s. | n.s. | 0.000 |
| | Netherlands+ | | Netherlands+ | | | | | | | |
| t2 | –0.482 | 5.928 | 0.577 | –6.240 | –0.132 | 7.004 | 2.782 | 2.885 | 1.020 | 6.648 |
| degrees of freedom | 554 | 554 | 522 | 555 | 554 | 555 | 555 | 553 | 555 | 555 |
| Significance | non-significant | 0.000 | n.s. | 0.000 | n.s. | 0.000 | 0.006 | 0.004 | n.s. | 0.000 |

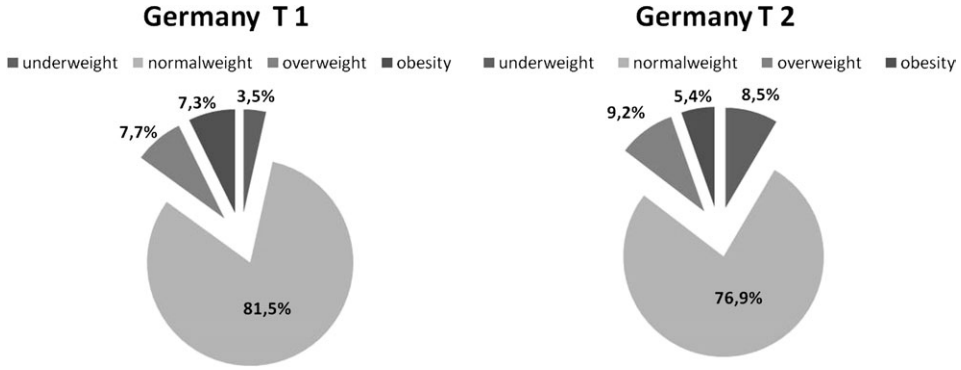


FIGURE 2 *Prevalence of overweight and obese children of the German cohort*

*Participants*

Presented results base on data of 557 children from Germany (Ng = 261) and the Netherlands (Nn = 296). Children came from different cities near the Dutch–German border and were in average 7.09 (SD = 0.56) years old when intervention 'gkgk' started and first measurement took place. German children's age (7.24, SD = 0.24) and Dutch children's age (6.96, SD = 0.56) differed marginal significantly from each other. After intervention measurement 2 took place ~11 to 13 months later (depends on communities and schools) so that the age of German children was 8.19 (SD = .50) years and the age of Dutch children was 7.70 (SD = 0.92) years. Whole participants together were at measuring point two 7.97 years old (SD = 0.78). Two hundred and ninety-one boys (Germany 143 and Netherlands 148) and 266 girls (Germany 118 and Netherlands 148) took part in both measuring points.

In total, 744 children of 6 German and 13 Dutch schools took part in these cohorts. But here, only results of those children are presented; we have data of both measuring points for.

*Procedure*

During PE lessons at school, motor ability was tested. Test items were sit-ups, push-ups, standing broad jump (all power measurements), 6-minute run (endurance), 20-m run (speed), balance backwards, rapid alternation jumps sideways (all coordination) and sit and reach (flexibility). Furthermore, data for BMI were collected and translated into percentiles by norm indices of Kromeyer-Hauschild *et al.*[11] Test items and test execution were based on German test manual DMT-6-18[12] except sit and reach test, which is an item of the 'Euro-Fit' test battery used in the Netherlands instead of stand and reach in the DMT-6-18.

Data of measuring points t1 and t2 were collected and compared with each other. Categories of motor ability in quintiles like at Bös *et al.* have not been built yet so that only original values can be presented here. Dutch and German results were also compared although samples differed marginal significantly in age and gender distribution.

Special focus was set on children in BMI percentiles p7 and p8 (children with obesity) at t1. Changes of percentiles [e.g. from obesity (p8) to overweight (p7)] and weight development of these children were deeper explored.

## Results

*Results for motor ability development t1 and t2*

Results are separated for countries because intervention time and implementation differed from each other. Motor ability development in Germany in between these 11 months of intervention show significant

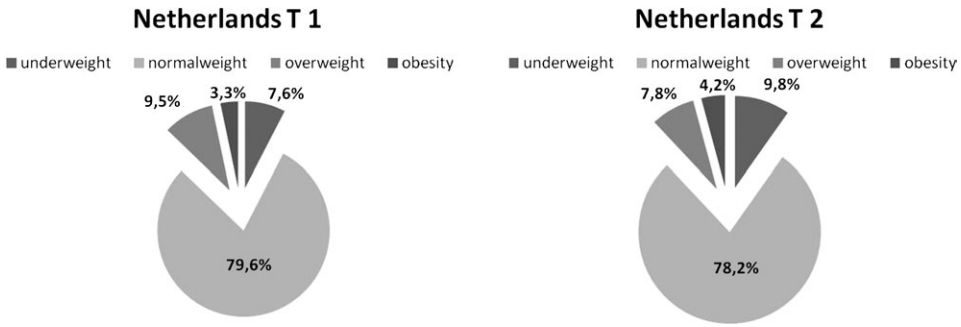


FIGURE 3 *Prevalence of overweight and obese children of the Dutch cohort*

improvements for sit-ups [$F$ (1, 259) = 126 862, $P < 0.001$, $\eta^2 = 0.329$], push-ups [$F$ (1, 259) = 70 660, $P < 0.001$, $\eta^2 = 0.214$], 20-m run [$F$ (1, 260) = 184 065, $P < 0.001$, $\eta^2 = 0.414$], standing broad jump [$F$ (1, 259) = 11 154, $P < 0.001$, $\eta^2 = 0.041$], rapid alternations jumps [$F$ (1, 2602) = 277 000, $P < 0.001$, $\eta^2 = 0.516$], balance backwards [$F$ (1, 260) = 54 761, $P < 0.001$, $\eta^2 = 0.174$] and 6-minute run [$F$ (1, 257) = 113 946, $P < 0.001$, $\eta^2 = 0.307$].

Dutch results show similar developments: sit-ups [$F$ (1, 295) = 84 995, $P < 0.001$, $\eta^2 = 0.224$], push-ups [$F$ (1, 295) = 47 001, $P < 0.001$, $\eta^2 = 0.137$], 20-m run [$F$ (1, 295) = 42 559, $P < 0.001$, $\eta^2 = 0.126$], standing broad jump [$F$ (1, 295) = 55 942, $P < 0.001$, $\eta^2 = 0.159$], rapid alternations jumps [$F$ (1, 295) = 215 492, $P < 0.001$, $\eta^2 = 0.422$], balance backwards [$F$ (1, 295) = 51 271, $P < 0.001$, $\eta^2 = 0.148$] and 6-minute run [$F$ (1, 295) = 27 419, $P < 0.001$, $\eta^2 = 0.085$]. We have large effect sizes for sit-ups, standing broad jump, rapid alternations jumps and balance backwards and average effect sizes for the other four. Results of sit and reach decrease significantly due to typical body changes at this age [$F$ (1, 292) = 20 730, $P < 0.001$, $\eta^2 = 0.066$].

*Results for differences between German and Dutch group*

Comparison between Germany and the Netherlands at t1 shows differences between both groups before intervention. Two-side *t*-tests show that German children were significantly better in push-ups, 20-m sprint, standing broad jump, rapid alternations jumps and balance backwards and Dutch children were significantly better at sit-ups and sit and reach (for all *t*-test results, see Table 1). In contrast to these results at measuring point t2, we can see that German children (who took part in average 2 months longer and who were older than the Dutch) were significant better at push-ups, 20-m run, rapid alternations jumps, balance backwards and 6-minute run. No significant differences were found at sit-ups, sit and reach and standing broad jump. For detailed *t*-test results, see Table 2.

*Results for BMI percentiles with special focus on p7 and p8*

BMI of children was in mean at an average level (see Table 1). In both countries, BMI increased significantly from t1 to t2 [Germany: $F$ (1, 260) = 14 079, $P < 0.001$, $\eta^2 = 0.051$ and Netherlands: $F$ (1, 295) = 15 128, $P < 0.001$, $\eta^2 = 0.049$]. These results correspond with normal effects of growth. For this study, important findings are the effects of intervention for children in BMI percentiles 7 and 8 (heavy overweight and obesity). In Germany, the number of members of these percentiles decreases from 15% to 14.6% (see Fig. 2). In the first year of 4 years intervention, 5 of 19 children with obesity dropped out of this percentile (decrease from 7.3% to 5.4%).

In the Netherlands, size of p7 and p8 decreased from 12.8% to 12%. Here, lower increase for obesity (p8) and heavy underweight (p1, from 7.6% to 9.8%) must be explored deeper in further time of intervention (Figs. 2 and 3).

## Conclusions

First results of the German Cohort 1 longitudinal measurements (2009/2010) indicate the possibility to counteract obesity and to increase levels of physical fitness and motor development independent from natural growth by a multi-component programme and a multi-sector approach of intervention.

Original values of Motor Ability Tests show significant increase in endurance, coordination, velocity and force tasks. Also, first changes for BMI distribution are explored in only 1 years intervention. In the next 2–5 years, in which intervention goes on, analysis should be expanded. Parents' questionnaire and children's questionnaire should be analysed to show factors for successful intervention. Factor analysis and hierarchical linear modeling should take emphasis on the following question: which are the important components of the project or is the whole construct of combined and networked action necessary? Results show that the project started successfully. In future, the longitudinal design of the study gives the chance to have a look on long-term effects and reasons for the first outcomes.

## Declaration

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Ethical approval: Ethical approval was approved by individual parents' agreement.
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