**Author's response to reviews**

**Title:** Is central obesity associated with health and health related quality of life in primary school children? Cross-sectional results from the Baden-Wuerttemberg Study

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We would like to thank the reviewer for her helpful comments and suggestions. We have tried to respond to all questions and to improve some aspects of our manuscript.

**Referee 1:**

**Major Compulsory Revisions:**

1. Discussion: Provide interpretation and a discussion of potential bias based on the analysis of the missing data (numerous differences in baseline characteristics). How might this affect the results?

*Changes made in the manuscript:*

Discussion – Strengths and Limitations, page 12

[Due to the restrictions of an observational study, compared to a clinical study, the present research shows some limitations concerning missing data and selection bias. Missing data in various variables diminished the number of subjects in the logistic regression from 1888 to 1331 (70.5 %). Missing data may have led to a form of selection bias but, in the best case, only lessen the precision of the study [53] and according to the differences observed in the analyses of missing data in this study, underestimated the dimension and significance of the results. ] As the missing data analysis implies, participants with missing data predominantly showed an unfavorable profile in the critical variables: higher proportion of migrants, lower family education level, more absence days of working mothers, less often categorized as sportingly active and a higher proportion of mothers who smoke. If those participants could have been included into the analysis, this probably would have meant a stronger evidence for the present results.
Statement of the authors:

We have extended the discussion of the missing data to meet the requirements

Minor Essential Revisions:

1. Background, paragraph 4: I am confused by the last sentence. Please re-write to define "it" and remove the words "experience with." Also provide a reference.

Changes made in the manuscript:

Background – paragraph 4, page 3

Only little information about HRQoL in children with central obesity is available, but according to obesity classified by BMI [15-17], HRQoL can also be expected to tend to be lower.

2. Background: Define/describe KINDL, for readers unfamiliar with this scale.

Changes made in the manuscript:

Background – paragraph 4, page 3

The KINDL\textsuperscript{R} (Revidierter KINDer Lebensqualitätsfragebogen) questionnaire is currently the most broadly used HRQoL instrument for children and adolescents in Germany, and has been translated into many languages (www.kindl.org) [18]. The KINDL\textsuperscript{R} includes indicators for physical, psychological, family, social and school well-being, and self-esteem [18].

3. Methods, paragraph 1: Define what is meant by "positive results." Does this mean weight loss was achieved, or a proportion of students moved from obesity to overweight or normal weight? Or something else?

Changes made in the manuscript:

Methods – paragraph 1, page 4

Based on the positive results of the URMEL-ICE study as regards a reduced increase in waist circumference and a favorable cost-effectiveness [29, 30], a health-
promotion program for primary schools in the state of Baden-Württemberg (South-Western Germany) was developed at Ulm University which has been implemented since 2009.

Statement of the authors:

We have specified the “positive results”.

4. Methods, Health and HRQoL paragraph: Replace "should indicate" with "indicated."

Changes made in the manuscript:

Methods – Health and Health Related Quality of Life, page 6

Working parents indicated the number of days they had to take off work to care for their sick child.

5. Results, paragraph 1: Replace "less" with "fewer" in the sentence "BMI, BMI percentile, ... no underweight and FEWER normal weight.."

Changes made in the manuscript:

Results – Baseline Characteristics, page 6

BMI, BMI percentile and WC were higher in the high WHtR group (p < 0.001), no underweight and fewer normal weight but more overweight and obese children were in the high WHtR group (p < 0.001).

6. Tables 1 and 2: Provide p values to indicate statistically significant differences by WHtR status.

Statement of the authors:

We added the p values to the Tables 1 and 2

7. Table 3: Add one sentence to the Odds Ratios paragraph in the Results section to interpret the ORs in this table (for significance and direction of association).
Changes made in the manuscript:

Results - Odds Ratios from Stepwise Logistic Regression Analysis for Higher Level of Child Absenteeism, page 9

Age (p < 0.001), physical activity (p = 0.001), tertiary family education level (p = 0.001), and high level of maternal health consciousness (p = 0.049) were inversely associated with a higher level of child absenteeism. In contrast, WHtR (p = 0.010), and migration background (p = 0.001) were positively associated with a higher level of child absenteeism.

8. Discussion, paragraph 1: Lead the discussion with a summary and interpretation of the results of this study.

Changes made in the manuscript:

Discussion – Critical Interpretation and Meaning, page 9

Children with central obesity in this cross-sectional study showed higher rates of absence, more visits to a physician and lower HRQoL. Central obesity and migration status increased the chance of children having more than 5 days of sickness absence to 182 %, and 155 %, respectively. On the other hand, regular physical activity (≥ 60 min/day for at least 4 days a week) reduced the chance of a higher level of absence by 52 %. Further factors that reduced the chance of a high level of sickness absence were age (92 % lower chance per year), maternal health consciousness (25 % lower chance) and family education level (47 % lower chance). Regarding a higher level of sick days, parents of central obese children recalled significantly more visits to a physician than parents of children without central obesity. Suitably in addition, children with central obesity showed significantly lower values in HRQoL, EQ VAS as well as in the KINDLR subscales "friends" and "school".

9. Discussion, paragraph 3: Provide references for the discrimination towards belly fat indicated in the third sentence. Also provide a reference for the final sentence in regards to central obesity interfering with physical activity.

Changes made in the manuscript:
Lower HRQoL found in the subscales "school" and "friends" may be due to a more visible sign of central obesity such as a belly, and children can be very cruel in pointing out what makes other children different from themselves [43].

Additionally, central obesity may slow down or prevent children from taking part in active play during break time and physical education lessons [45].

10. Discussion: When discussing results, all verbs should be in past tense.

Statement of the authors:

We tried to do so.

11. Discussion, paragraph 4: Provide further description of ref 44 regarding the relationship between physical activity and health. This entire paragraph needs more coherence and better transitioning. It reads as a list of findings rather than a coherent thought.

Discussion, paragraph 5, page 10

The strongest factor associated with a higher level of sick leave besides age was central obesity, respectively a WHtR beyond the cut-off point. As a second influenceable factor, children's physical activity level was identified in this study. According to Kim and Lee, abdominal obesity is strongly dependent on physical activity levels in youth [46], so it is understandable that both variables were significantly associated with higher levels of sick leave. Further, many authors have already addressed physical activity as an important determinant of physical and psychological health, suggesting the dose-response relations found in observational studies indicate the more physical activity, the greater the health benefit [47, 48].

Maternal health consciousness, a further influenceable factor identified in the present research, may directly influence the child's health, as the mother usually is the most important care giver, maintaining the well-being of the child for whom she cares. Migration status and family education level are unchangeable components, both are also known risk factors for childhood overweight and obesity [49]. Possibly migration and lower levels of education lead to less concern for health behaviors, resulting in a
greater chance for more sick days. Age is a constantly growing unswayable measure and as children grow older, their immune system is supposed to grow stronger and their parents may have fewer concerns about their health.

Statement of the authors:

This paragraph was partly re-written

12. Discussion, paragraph 5: The fourth sentence does not make sense and may be missing verbs or other words.

Changes made in the manuscript:

Discussion, paragraph 6, page 11

Baxter et al. did not find significant relationships of absenteeism with age and gender specific BMI percentiles, and socio economic status, respectively, but a significant inverse relationship with academic achievement in fourth grade children [11].

13. Discussion, paragraph 6: This paragraph contains no references and appears to be the authors’ opinions. Please provide citations to justify the interpretation of the results.

Changes made in the manuscript:

Discussion, paragraph 7, page 11

Central obesity seems to condense the health risks of obesity [51], otherwise one would not expect to find the reported associations at an early stage in such a young population. Children at the start of school are subjected to a change of lifestyle with increasing sedentary behavior and decreasing physical activity levels [52], which can easily be explained by the essential demands of the current character of schooling. Higher levels of sick leave are substantially consistent with lower levels of HRQoL and do not need to be explained any further. Thus, by promoting physical activity in school and reducing time spent sedentary, central obesity may be reduced as well as sick days, and consequently HRQoL may be increased.

Statement of the authors:
We added some references.