

# Associations Between Migration Background and Media and Information Behavior in Primary School Children

## Authors

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## ABSTRACT

**Background** Children with migration background and from low socio-economic status are at higher risk for overweight. To determine appropriate media channels to possibly reach children with targeted health information, it has to be considered that the media and information behavior of children has changed during the last decades.

**Objective** We examined the media and information behavior of children in low socio-economic districts, focusing on those with migration background.

**Methods** Fourteen 3<sup>rd</sup> grade classes (n = 250 children, 68.0% with migration background) completed a questionnaire regarding their media consumption, which was based on existing validated surveys.

**Results** ≥ 50 % of the children watched TV and around 40 % used both mobile phones and computers/tablets/internet for ≥ 1 h/day. Books were the most popular analogue media (61.6 % of children), whereas magazines/newspapers and radio (18.4 and 16.0 % of children, respectively) were used less frequently. Furthermore, they regularly used internet, TV and their teachers (63.0, 48.8 and 44.8 % of children, respectively) as information source. Especially children with compared to those without migration background less likely used the radio (P = 0.0002) and their family as information source (P = 0.0017).

**Conclusions** Children attending 3<sup>rd</sup> grade class, especially with migration background, can be addressed through digital media rather than the radio. This may help to sustainably support children outside school with targeted health information.

## Introduction

Unbalanced nutritional and sedentary behavior increase the risk for the development of lifestyle-related diseases, such as overweight, obesity and type 2 diabetes in children. According to the World Health Organization (WHO), obesity is an independent chronic disease [1]. It represents an important risk factor for metabolic, cardiovascular and tumor diseases [2]. Currently, the prevalence of overweight children in Germany increases from 10.8 % for girls and 7.3 % for boys aged 3–6 years to 14.9 and 16.1 % in the age group of 7–10 years, respectively [3]. Especially, the children with migration background and low socio-economic status are at a higher risk for overweight and obesity [4]. As health-related attitudes and behavior are imprinted in early childhood, health education programs should start as early as possible [5]. In addition to the family, the primary school is a critical time period for the child's health development and also represents an appropriate setting to improve the children's nutritional and physical activity behavior through preventive methods and activities [6, 7].

We have previously shown that a school-based intervention based on weekly guided physical education (PE) lessons and practical nutrition lessons for 3<sup>rd</sup> and 4<sup>th</sup> grade primary school children with a high proportion of migration background improves the children's fitness and motor skills as well as their nutrition-related knowledge and skills [8, 9]. In addition, the PE lessons had favorable effects on their heart rate variability and blood pressure [10]. To provide further prevention tools for children at high risk and to support them with targeted health information outside of school, it is necessary to identify their information and media behavior as well as the appropriate media channels to reach those children. However, the media and information behavior of children has substantially changed during the last decades. Digital media, such as a computer, mobile phones and the internet, play an increasingly important role in the children's daily life [11, 12]. A large amount of their leisure time encompasses passive activities such as using smart phones and the internet as well as watching TV. Especially the role of the family and socio-economic status play an important part in respect to the media consumption. Children with a higher media consumption generally come from parents who are lower educated [13].

This development is likely to contribute to the rise of overweight and obesity in children. Previous surveys showed a relationship between the user frequency of screen media and lower physical activity as well as higher consumption of energy-rich foods [14–16]. However, currently no studies have assessed the media and information behavior of children with migration background between the ages of 8–10 years.

Thus, the aim of this study was to assess the information and media behavior of 3<sup>rd</sup> grade primary school children in low socio-economic districts with a focus on those with migration background.

## Methods and Materials

### Study population

The survey was conducted between 05/2017 and 06/2017 in fourteen 3<sup>rd</sup> grade primary school classes from eleven schools who participated in the initiative 'SMS. Sei schlau. Mach mit. Sei fit.'

['Be smart. Join in. Be fit.'] (<http://www.sms-mach-mit.de>) during that school year. The SMS initiative addresses specifically schools in low social-economic districts with a high proportion of migration background in Düsseldorf [8–10, 17]. In addition, the selection of the schools was based on poor results of 'Check!' test, which is an annual test on physical fitness and motor skills conducted by the Sport Department of Düsseldorf in all 2<sup>nd</sup> grade primary school classes in Düsseldorf [18]. Within the SMS initiative, pupils with an increased risk for overweight and lifestyle-related diseases are made aware of the benefits of a balanced diet and more exercise. Due to the study design, the body weight and height of the children were not measured in the present study. However, the data were collected in a previous study from the SMS initiative [8] showing that 8.2 % of the participating children were overweight and 5.6 % obese.

The evaluation was approved by the ethics board of Heinrich Heine University Düsseldorf and performed according to the 2013 version of the Declaration of Helsinki. Both, the children and the parents were asked for their consent and parents also gave written informed consent prior to their children's participation.

### Development and implementation of the questionnaire

The self-administered questionnaire consists of two main parts, i. e. the children's background information and their media and information behavior. The questions regarding the media and information behavior of the children were based on the following five key questions: (1) Which media and how often do children use these media? (2) For which purpose do children use these media? (3) What is the children's attitude towards a particular media? (4) How do parents influence their children regarding their leisure time activity, including their media use? and (5) What are the leisure time activities of children and how often do they practice them? The individual questions were taken from existing open access and validated inquiries for the considered age group [19–22]. If the original survey could not be found, we contacted the authors of those publications. By nonresponses, we used figures or tables from corresponding publications to derive the related question [23–25]. If the templates for questions that were considered to be important for our evaluation were missing for the respective age group, questions from surveys addressing adolescents [14, 26] or adults [27] were used. Overall, the survey included 18 questions, 16 addressing the media and information behavior of the children and two additional questions referred to the number of persons living in the household and the native language of the children. This latter was used to classify the children according to migration or non-migration background.

All children from the included classes participated on the survey and completed the self-administered questionnaire in the classroom during a school lesson. A person who conducted the survey was available for comprehension problems during the whole duration. The majority of the questions about the media and information behavior of the children consisted of Likert Scale questions ranging a 2-point to an 8-point scale, in which the children had to mark the appropriate answer [28]. The survey included only three open questions where the children could write their own answers. Within the survey, the teachers added the children's birth dates

and gender as well as assessed their language skills (rather good, satisfying, problematic).

## Statistical analyses

Baseline characteristics as well as the general media and information behavior of the children are presented as mean  $\pm$  standard deviation (SD) and n (%). The media and information behavior of the children with and without migration background is given as a percentage for each response. Only questionnaires of children who completed more than 80 % of the questions were included in the analyses (n = 250). Global P-values are adjusted for age at survey, sex and school by simple and multivariable logistic regressions. Global  $P < 0.05$  was considered statistically significant. The issue of multiple testing was accounted for by additionally applying Bonferroni correction individually for each key question regarding the media and information behavior of the children of the questionnaire using  $P < 0.05/5$  as significance level. Statistical analyses were conducted using SAS (version 9.4; SAS Institute, Cary, NC).

## Results

### Characteristics of the study population

The survey included 250 children of fourteen 3<sup>rd</sup> grade classes in low socio-economic districts of Düsseldorf, North Rhine-Westphalia, Germany. 68 % of them indicated to have a second native language and were thus classified as having a migration background. On average, the children were nine years old and lived in a four-person household. Their teachers assessed the children's language skills and concluded that 55.6 % were "rather good" and 16.4 % were "rather problematic" (► **Table 1**).

### Media and information behavior of the study population

Which media and how often do children use these media?

Irrespective of their origin, the children reported that 92 % have a mobile phone and 90 % a TV at home and 12 % had a newspaper subscription at home.

The most frequently used device during leisure time (comprising school days and weekend) was the TV (53.5 % of the children used it at least one or more hours/day), followed by 40.9 % of children using at least one hour or more per day of computer/tablet/

internet as well as books (39.3 %) and mobile phones (38.1 %), respectively (Supplementary ► **Table 1S**).

For which purpose do children use these media?

68.6 % of all participating children reported that they never use the radio as an information source, whereas 75.8 % very often or often consult their family (Supplementary ► **Table 2S**). Further information sources, which were similarly often used by children with and without migration background, were the internet ((very) often by 63 % of the children), books ((very) often by 48.6 % of the children) and the TV ((very) often by 48.8 % of the children) as well as the children's teachers ((very) often by 44.8 % of the children). 58 % of the children never used the dictionary and newspapers or magazines as an information source (Supplementary ► **Table 2S**).

With respect to the internet, most of the children liked to watch videos or used the video platform YouTube. Other popular topics were playing computer games and apps. Many children also reported the use of search engines like Google and communication platforms or chats like WhatsApp. With regards to reading, children were interested in children's, fantasy or magic (i. e. "Harry Potter") and non-fiction books. By TV, fantasy as well as non-fiction children's series (including those which transmit knowledge) and movies were the most popular. Less than half of the children answered the question: "On magazines and newspapers, I am interested in these topics: ...". Those children providing an answer, most frequently listed comics and news, the latter including for example articles about Syria or America (data not shown).

The majority of children (67.5 %) indicated to turn on the TV for entertainment purposes. 53.3 % of the children (very) often turn on the TV to watch an educational program and 71.1 % of them rarely or never watch the news (Supplementary ► **Table 2S**).

63.8 % of the children considered that one can (very) often obtain some information from magazines. Additionally, most of the children (81.1 %) reported that they rarely or never read or glance through a magazine together with other children, but 61 % (very) often do this together with their parents (Supplementary ► **Table 2S**). Worksheets are the most frequently used material to work with for school and about a half to two thirds of the children indicated that they (very) often also use the internet (49.2 %) or textbooks (65.3 %) for this purpose (Supplementary ► **Table 2S**). If children use the computer at home for school, they most commonly used it to write texts or words (62 % of the children), to perform calculations (57.2 % of the children) or to read or search for something on the internet (58.3 % of the children) (Supplementary ► **Table 2S**).

What is the children's attitude towards a particular media?

Irrespective of the children's origin, they considered an internet access as the most important media for children in their age group. In addition, 34.4 % of the children and 21.6 % of them totally agreed that it is important to have their own TV and to have their own computer or notebook, respectively (Supplementary ► **Table 3S**).

With respect to their views on the internet, 57.8 and 55.2 % of the children agreed to the statements "If I use the internet, I know exactly what is allowed and what is not allowed" and "It is fun to learn and work with the computer". The statement "What you can read on the internet had been previously checked for correctness"

► **Table 1** Baseline characteristics of the children.

| Characteristics  |               |
|--|---------------|
| n (% males)  | 250 (41.2 %)  |
| Age [years]  | 9.0 $\pm$ 0.7 |
| Migration background [n (%)]                             | 170 (68.0 %)  |
| Household size [persons]                                 | 4 $\pm$ 1     |
| Language skills [n (%)]                                  |               |
| Rather good  | 139 (55.6 %)  |
| Satisfying   | 70 (28.0 %)   |
| Rather problematic                                       | 41 (16.4 %)   |
| Data are n, n (%) or mean $\pm$ standard deviation (SD). |               |

received the lowest amount of consent from the children (21.8%) (Supplementary ► **Table 3S**).

How do parents influence their children regarding their leisure time activity, including their media use?

31.6% of the children reported that they decide on their own what they do with the computer, while for 37.6% of the children, this decision is solely made by the parents. Furthermore, 61.1% of the parents monitored what their children watch on TV or video and 51.2% were interested in what their children were reading, while 63.1% of the children reported that they decided on their own which sport they do in their free time (Supplementary ► **Table 3S**).

Which are the leisure time activities of children and how often do they practice them?

Overall, 93.8% of the children reported to do some physical activity in their free time and 82.8% of them did it daily to several times weekly. 47.4% of the children went to an after-school day care center or another care facility and similarly to their sport behavior 80.7% attended these facilities daily to several times weekly. 79.8% of the children reported that they liked to read a book or to go to the library to borrow a book (60.6%) during their leisure time (Supplementary ► **Table 3S**).

Media and information behavior of the children with and without migration background

Comparing the differences in the media and information behavior between children with and without migration background, four of the 13 questions showed associations that were still significant after Bonferroni correction, whereas the findings of one further question with associations were no longer significant after Bonferroni correction. All of the other questions did not show any difference in media and information behavior between children with and without migration background.

Children with and without migration background differed in their media use with respect to the radio: The existence of a radio at home was more often reported by children without migration background (62.5% without vs. 35.9% with migration background,  $P = 0.0005$ ). A comparable but less pronounced result was found for its use (26.3% without vs. 11.2% with migration background,  $P = 0.0064$ ) (► **Table 2**). This was also confirmed by the question “Do you listen to the radio (during your leisure time)?” (60.8% without vs. 33.9% with migration background,  $P = 0.0002$ ) (► **Table 2**). However, the general use of this media was low among the whole study population (Supplementary ► **Table 1S**) and there was no difference between children with and without a migration background with regards to the listening frequency of the radio (“How long do you spend on average per day with the radio?”,  $P = 0.8795$ ) (Supplementary ► **Table 4S**).

In addition, children with migration background reported a higher use of the mobile phone (70.6% with vs. 55.0% without migration background), but a lower use of newspapers/magazines (13.5% with vs. 28.8% without migration background) during their free time ( $P = 0.0462$  and  $P = 0.0094$ , respectively). The result regarding the use of the mobile phone was no longer significant after Bonferroni correction (► **Table 2**).

► **Table 2** Differences in the media and information behavior between children with and without migration background for key question 1 and 5.

| <b>(1) Which media and how often do children use these media?</b>                                 |            |               |                 |
|---|------------|---------------|-----------------|
| <b>Which devices can be found at your home?</b>   |            |               |                 |
|   | <b>Yes</b> |               | <b>P</b>        |
|   | <b>MB</b>  | <b>non MB</b> |                 |
| TV  | 89.4       | 91.3          | 0.9262          |
| Radio   | 35.9       | 62.5          | <b>0.0005 *</b> |
| Newspaper subscription  | 11.2       | 13.8          | 0.6169          |
| Internet access   | 66.5       | 62.5          | 0.4117          |
| Computer/laptop/tablet  | 86.5       | 82.5          | 0.0815          |
| Mobile phone  | 92.9       | 90.0          | 0.2199          |
| <b>Which media do you use during your free time?</b>  |            |               |                 |
|   | <b>Yes</b> |               | <b>P</b>        |
|   | <b>MB</b>  | <b>non MB</b> |                 |
| TV  | 77.1       | 70.0          | 0.1878          |
| Radio   | 11.2       | 26.3          | <b>0.0064 *</b> |
| Books   | 60.6       | 63.8          | 0.7901          |
| Computer/tablet (for games)   | 60.0       | 65.0          | 0.7133          |
| Computer/tablet (for internet)  | 41.2       | 38.8          | 0.6176          |
| Newspapers/magazines  | 13.5       | 28.8          | <b>0.0094 *</b> |
| Mobile phone  | 70.6       | 55.0          | <b>0.0462</b>   |
| Other   | 41.8       | 43.8          | 0.7825          |
| <b>(5) Which are the leisure time activities of children and how often do they practice them?</b> |            |               |                 |
| <b>Which of the following leisure time activities do you do?</b>                                  |            |               |                 |
|   | <b>Yes</b> |               | <b>P</b>        |
|   | <b>MB</b>  | <b>non MB</b> |                 |
| Do you play any sport?  | 93.8       | 93.6          | 0.4410          |
| Do you go to an after-school day care center or another care facility?                            | 43.1       | 56.4          | 0.0863          |
| Do you read during your free time?  | 78.2       | 83.3          | 0.4369          |
| Do you go to a sports club or another association?  | 52.2       | 57.5          | 0.4448          |
| Do you go to a youth group/a leisure time facility or a children`s and youth club?                | 25.0       | 18.8          | 0.2394          |
| Do you go to the library to borrow books?   | 61.1       | 59.5          | 0.7686          |
| Do you listen to the radio?   | 33.9       | 60.8          | <b>0.0002 *</b> |

The table provides the percentage of children with and without migration background for each response (%) and global P-values. Global P-values are adjusted for age, sex and school [school 1/school 2/school 3/school 4/school 5/school 6/school 7/school 8/school 9/school 10/school 11] by logistic regression. **Bold** indicates significant associations ( $P < 0.05$ ). MB = migration background. \* Findings still significant after Bonferroni correction (significance level  $P < 0.05/m$  with  $m$  equaling the number of questions,  $P < 0.05/5 \triangleq P < 0.01$ ). The results of the further questions that belong to key question 1 and 5 are shown in Supplementary ► **Table 4S** (key question 1) and Supplementary ► **Table 6S** (key question 5).

Furthermore, more children with migration background reported that they never inform themselves through the radio ( $P = 0.0002$ ) and more rarely through their family compared to children without migration background ( $P = 0.0017$ ) (► **Table 3**).

► **Table 3** Differences in the media and information behavior between children with and without migration background for key questions 2–4.

| <b>(2) For which purpose do children use these media?</b>   |                 |        |                  |        |                         |        |                       |        |                 |
|---|-----------------|--------|------------------|--------|-------------------------|--------|-----------------------|--------|-----------------|
| <b>When you want to learn about a topic to talk about with your good friends, how often do you get the information from...</b>  |                 |        |                  |        |                         |        |                       |        |                 |
|   | Very often      |        | Often            |        | Rare                    |        | Never                 |        | P               |
|   | MB              | non MB | MB               | non MB | MB                      | non MB | MB                    | non MB |                 |
| TV?   | 26.0            | 16.5   | 26.0             | 25.3   | 25.5                    | 31.6   | 22.5                  | 26.6   | 0.3647          |
| the radio?  | 3.0             | 5.0    | 4.8              | 15.0   | 14.6                    | 30.0   | 77.6                  | 50.0   | <b>0.0002 *</b> |
| the dictionary?   | 9.1             | 10.2   | 9.1              | 10.3   | 22.6                    | 24.4   | 59.2                  | 55.1   | 0.8582          |
| books?  | 18.0            | 16.7   | 31.0             | 30.8   | 22.4                    | 26.9   | 28.6                  | 25.6   | 0.8656          |
| newspapers or magazines?  | 9.3             | 6.6    | 9.3              | 13.2   | 19.9                    | 28.9   | 61.5                  | 51.3   | 0.2165          |
| the internet?   | 33.7            | 35.9   | 30.1             | 25.6   | 15.9                    | 23.1   | 20.3                  | 15.4   | 0.5632          |
| your family (father, mother or siblings)?   | 51.8            | 44.9   | 19.9             | 39.7   | 18.7                    | 6.4    | 9.6                   | 9.0    | <b>0.0017 *</b> |
| your teachers?  | 28.8            | 18.4   | 20.9             | 15.8   | 28.2                    | 26.3   | 22.1                  | 39.5   | 0.0726          |
| other people?   | 11.5            | 5.1    | 13.9             | 15.4   | 24.3                    | 15.4   | 50.3                  | 64.1   | 0.1852          |
| <b>(3) What is the children's attitude towards a particular media?</b>  |                 |        |                  |        |                         |        |                       |        |                 |
| <b>Please check the box to indicate your views on the internet are:</b>   |                 |        |                  |        |                         |        |                       |        |                 |
|   | I totally agree |        | I somewhat agree |        | I somewhat do not agree |        | I do not agree at all |        | P               |
|   | MB              | non MB | MB               | non MB | MB                      | non MB | MB                    | non MB |                 |
| Internet is part of daily life.   | 53.9            | 38.0   | 29.1             | 45.6   | 9.7                     | 12.6   | 7.3                   | 3.8    | 0.0695          |
| Internet is useful for school.  | 35.6            | 14.5   | 22.1             | 23.7   | 22.7                    | 32.9   | 19.6                  | 28.9   | <b>0.0104</b>   |
| Most of my friends spend time on the internet.  | 39.2            | 23.1   | 30.7             | 37.2   | 16.9                    | 29.5   | 13.2                  | 10.2   | <b>0.0277</b>   |
| If I use the internet, I know exactly what is allowed and what is not allowed.  | 56.1            | 61.5   | 22.3             | 23.1   | 10.8                    | 15.4   | 10.8                  | 0.0    | 0.9059          |
| There is too much attention about the internet.   | 23.9            | 18.2   | 37.1             | 37.6   | 20.1                    | 27.3   | 18.9                  | 16.9   | 0.7166          |
| What you can read on the internet has been previously checked for correctness.  | 22.4            | 20.5   | 25.5             | 19.2   | 27.9                    | 37.2   | 24.2                  | 23.1   | 0.5676          |
| It is fun to learn and work with the computer.  | 59.6            | 45.4   | 22.3             | 22.1   | 9.7                     | 23.4   | 8.4                   | 9.1    | <b>0.0475</b>   |
| Computers are for the free time.  | 36.2            | 25.6   | 26.3             | 23.1   | 20.0                    | 28.2   | 17.5                  | 23.1   | 0.2349          |
| Actually, I would like to use the computer more often.  | 28.3            | 21.8   | 12.1             | 15.4   | 27.7                    | 35.9   | 31.9                  | 26.9   | 0.4902          |
| <p>The table provides the percentage of children with and without migration background for each response (%) and global P-values. Global P-values are adjusted for age, sex and school [school 1/school 2/school 3/school 4/school 5/school 6/school 7/school 8/school 9/school 10/school 11] by multivariable logistic regression. <b>Bold</b> indicates significant associations (<math>P &lt; 0.05</math>). MB = migration background. * Findings still significant after Bonferroni correction (significance level <math>P &lt; 0.05/m</math> with <math>m</math> equaling the number of questions, <math>P &lt; 0.05/5 \hat{=} P &lt; 0.01</math>). The results of the further questions that belong to key questions 2–4 are shown in Supplementary ► <b>Table 5S</b> (key question 2) and Supplementary ► <b>Table 6S</b> (key questions 3 and 4).</p> |                 |        |                  |        |                         |        |                       |        |                 |

The children's view on the internet differed between whether or not they have a migration background in respect to the statements "Internet is useful for the school", "Most of my friends spend time on the internet" and "It is fun to learn and work with the computer" with children with migration background showing stronger agreement to these statements than children without migration background ( $P=0.0104$ ,  $P=0.0277$  and  $P=0.0475$ , respectively), with all results being no longer significant after Bonferroni correction (► **Table 3**).

## Discussion

The most popular media of a primary school children cohort with a high proportion of migration background and from low socio-economic districts were TV and mobile phone. Analogue media, with the exception of books, were only used infrequently. Especially children with migration background prefer digital media and inform themselves more rarely through their family compared to children without migration background.

Previous studies, which differed from the present study regarding their cohorts' characteristics, e. g. age range and migration background, showed comparable results in relation to the media equipment and user behavior of children [11, 29]. Nearly 100 % of the participating children (aged 6 to 13 years, 12–13 % of them had at least one parent with migration background) of the German study 'Kindheit, Internet, Medien' ['Childhood, internet, media'] (KIM) in 2016 and 2018 reported that there is a complete set of media equipment, which includes TV, internet and mobile phone, at home. Furthermore, the TV was the most frequently used media, followed by computers and mobile phones [11, 30]. Similar results were found in a survey on the media behavior of children between the ages of 6–10 years in Austria, with no data available about migration background [29]. The slightly higher amount of media equipment at home in comparison to the present study may be explained by the survey method as well as monetary reasons. Both surveys used interviews instead of a self-administered questionnaire and the SMS initiative particularly focuses on children from low socio-economic districts.

The preferred information sources of the present study population were the internet and TV alongside their parents and teachers. Further studies pointed out that the use of search engines were one of the most popular activities from children on the internet [25, 29, 31, 32]. Only watching videos on the video platform YouTube [29, 32], using communication platforms [32] or listening to music [25] were more popular than using search engines. Those findings confirmed the present result that the internet is growing to one of the important media for children as information source, but it is still mainly used for entertainment in the respective age group.

A similar behavior was seen with regard to the TV consumption. The previous German KIM study indicated that half of the children often turned on the TV to watch an educational program or the news [11]. The SMS initiative had comparable results in regard to the educational program. However, 71.1 % rarely or never watched the news. Furthermore, 53 % of the KIM study cohort also reported to turn on the TV without a particular reason [11]. This was found

to be true for only 32.5 % in the present population. The differences between the two studies could be based on the wider age range of the KIM study, which includes children between the ages of 6 and 13 years, and the change in media and information behavior with increasing age.

Despite of the important role of digital media in children's daily life, books were still popular and often used for school, as information source as well as during leisure time. The results of the previous Austrian survey confirmed these findings [29]. However, newspapers and magazines were only used rarely and infrequently in the present population and were thus classified as unsuitable media to transmit health-related knowledge to the target group. This is in line with the results of the KIM study [11], whereas the German study 'Kids Verbraucher Analyse' ['Kids Consumer Analysis'] from 2015 yielded that 89 % of the children between the ages of 6 to 13 years, with no data available about migration background, reported that they usually read or glanced through the whole magazines [25]. A possible explanation for this difference could be the method of the survey. While the present study applied a self-administered questionnaire, the 'Kids Verbraucheranalyse' interviewed the children in the presence of their parents.

Regarding the migration background, the present study demonstrated the low suitability of the analogue media radio, newspapers and magazines to transmit information to the targeted population. Trebbe et al. (2008) conducted a survey about the media behavior of adolescents and young adults with migration background. Via telephone and group discussions, they interviewed people between the ages of 12–29 years with Turkish or Russian origin [26]. In contrast to those data, the SMS initiative comprises children from up to 35 different countries of origin [17]. However, comparable to our findings, Trebbe et al. (2008) also revealed only a low proportion of participants with migration background that owned and/or used a radio as well as a newspaper/magazine subscription [26]. A possible explanation of these results is the required language comprehension to listen to local or regional radio stations or to read articles in German.

Two previous older studies [14, 33] and one current study [13] showed an association between the presence of migration background and a higher media use and screen time. The results of the present study only partly confirm those findings. In fact, children with compared to those without migration background reported a higher use of the mobile phone and strongly agreed to the statement that internet is useful for school and it is fun to learn and work with the computer as well as most of their friends spend time on the internet. However, these results were no longer significant after Bonferroni correction. Furthermore, there was no difference between children with and without migration background with regard to their use frequency of the digital media. Thus, children with migration background can be reached with the same media – with the exception of radio – as children without migration background.

Another difference between children with and without migration background was that children with migration background informed themselves more rarely through their family. However, also in children with migration background their family remained the most important information source.



## Strengths and limitations

A major strength of the study is the inclusion of a high proportion of children with migration background, including a large number of different countries of origin, and from low socio-economic districts. In addition, the questionnaire consists of existing open access and validated inquiries that were predominantly developed for the considered age group. This offered several opportunities to compare the results of the present survey to existing research. Furthermore, the questionnaire comprises all existing media and information sources. There are also several limitations. First, the used questionnaire queries the general media and information behavior of children and does not contain any specific questions about which source or media they use to gather health-related knowledge. Additionally, few of the used questions were developed for an older age group as the respective one and three questions were only derived from figures or tables of the corresponding publications. Secondly, the survey was only based on a self-administered questionnaire. Therefore, data on reliability could not be extracted from the results. Furthermore, the teachers of the participating classes partly considered the whole questionnaire or some single questions as too long (up to 50 min/survey) and difficult for children between the ages of 8–10 years. Additionally, some teachers pointed out that the children were not able to concentrate on one task as long as the questionnaire required. However, we are not sure, if the comprehension problems, i. e. the incomplete answering of some questions, occurred only because of the length and language level of the questionnaire, or also due to a general language barrier of children with migration background in the study. 16.4% of the children were graded by their teachers as “rather problematic” regarding their language skills. However, one study assistant was available for comprehension problems during the duration of the survey.

Third, there could be a recall bias, because the children had to estimate their use frequency of the different media per day. For children between the ages of 8–10 years, it could be difficult to judge the real time they spend on each media throughout the day [34]. Also, given that the children answered to the questionnaires during a regular school lesson, social desirability may have influenced children's responses. Moreover, the present survey did not specifically capture the social media use of the children. This aspect should be considered in further surveys, especially since YouTube, Instagram and other social media channels play an important role in children's daily life.

## Conclusions

In conclusion, digital media and books play an important role in the daily life of children of 3<sup>rd</sup> grade primary school classes with a high proportion of migration background and from low socio-economic districts. These findings can be used to effectively and sustainably reach these children with nutrition and physical activity knowledge outside school. However, it is important to consider that knowledge transfer alone is not necessarily sufficient to lead to a change of behavior. The method of intervention as well as emotional appeal and motivation of the target group via social media could have a beneficial influence and worth the effort.

## Authors' Contributions

LD wrote the manuscript and researched data; KSW and LN researched data; LD, LN, and KS performed the statistical analysis; MR, OS, PK, KSW and MV contributed to discussion and reviewed/edited the manuscript; MV, KSW and LN researched and compiled the survey; KM designed the study, contributed to the discussion and reviewed/edited the manuscript. All authors critically reviewed the manuscript. KM is the guarantor of this work and, as such, had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

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## Ethics approval and consent to participate.

The evaluation was performed according to the Declaration of Helsinki and approved by the ethics committee of Heinrich-Heine-University Düsseldorf (study reference number: 3963). All parents gave written informed consent prior to the participation of their children.

## Trial registration:

German Clinical Trials Register, DRKS-ID: DRKS00005119

## Conflict of Interest

The authors declare that they have no conflict of interest.

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