



From Science 2 School

A study on the diet and exercise behaviour of Austrian students and teachers/school principals

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Abstract

As part of the multidisciplinary cross-sectional study "From Science 2 School", the lifestyle behaviour of Austrian secondary school pupils, teachers and school principals was surveyed using a large sample with the help of an online questionnaire. For the first time the frequencies and distribution of various dietary patterns were linked with physical activity and sports in the school context.

Of the 8,799 pupils included, 84.3% followed a traditional (mixed) diet, 8.5% were vegetarian and 7.2% were vegan. 7.1% were overweight and 4.7% were obese. Of the 1,350 teachers and school principals who took part, 89.3% reported a mixed diet, while 7.9% were vegetarians and 2.9% were vegans. 25.6% were overweight and 8.8% were obese. Vegetarians had the lowest obesity rate. In addition, significant correlations were shown between regular physical activity and a higher consumption of fruit, vegetables and water ($p < 0.01$), and among pupils, between a vegan diet and a higher level of leisure time activity ($p < 0.01$). These findings can serve as a basis for recommendations aimed at promoting long-term healthy lifestyle habits within the school context.

Citation

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Introduction

A healthy lifestyle is of great importance at every stage of life. However, childhood and adolescence play particularly key roles due to the strong connection between behaviours in early years and later lifestyle choices, resulting in overall health status. On the one hand, habits are developed early in life and are usually maintained into adulthood. On the other hand, it is widely agreed that the origins of many chronic diseases occurring in adulthood, such as diabetes mellitus, cardiovascular diseases, and obesity, can be traced back to childhood and adolescence [1–3]. Individuals who have adopted a health-promoting lifestyle in childhood therefore have a better chance of maintaining good health in adulthood [4], whereas health problems that arise in childhood often persist into adulthood and can develop into more serious diseases [5]. Early intervention is therefore crucial to prevent serious health disorders [1–5].

The special importance of diet and exercise

While several lifestyle factors can positively or negatively influence young people's health, dietary and physical activity behaviours are considered particularly crucial for growth, development and performance, as well as being cornerstones of health promotion and disease prevention [6, 7].

Physical activity in the form of exercise and sport is essential for the physical and mental health of children and adults [8, 9]. Sufficient physical activity leads to improvements in cardiovascular function [8], cognitive performance, attention [9] and mental well-being [10], among other things. In contrast, insufficient physical activity and excessive screen time are associated with chronic diseases [11].

An age-appropriate, healthy diet also plays a key role in development and health. Research has long focused on various diets such as mixed diets, vegetarian and vegan diets and their effects on health. Results from the Global Burden of Disease Study indicate that approximately 20% of Western Europeans die prematurely due to unhealthy dietary habits, characterised by excessive consumption of meat and salt, and inadequate intake of plant-based foods such as fruits, vegetables, legumes, and nuts [12]. Plant-based foods are low in energy, cholesterol-free and low in saturated fats but rich in fibre, vitamins, and minerals [13, 14]. Consequently, a plant-based diet can act preventively and therapeutically against certain chronic diseases [15–17]. However, to avoid the risk of a possible under-supply or deficiency during development, children and adolescents following a vegetarian or vegan diet should always pay particular attention to adequate intake of all necessary nutrients [18]. Based on a solid body of evidence regarding the health benefits of vegetarian and vegan dietary patterns in the prevention and treatment of chronic diseases [13, 15, 18–20], there is consensus that a well-planned vegetarian or vegan diet is suitable for all stages of life, including childhood and adolescence [14, 15, 19, 21].

School as a "learning setting" for establishing a healthy lifestyle

Due to the nine years of compulsory education in Austria as well as further educational obligations for young people up to the age of 18, children and adolescents spend a significant part of their lives in the school setting.

As a place to live, learn and work, school is therefore an ideal environment for preventive measures and harbours great potential for improving public health at a societal level by improving the individual health of pupils and educators [22–26].

By acting as role models and multipliers, adults can have a decisive influence on the development of health-related behaviour in children and adolescents. This occurrence is particularly true for teachers in the school setting. Teachers can and should impart the importance of healthy behaviours to their pupils in addition to knowledge in the respective school subject [27, 28].

In fact, health education was legally established in the new general curriculum of Austrian secondary schools (middle schools, high schools) and higher education academies and vocational schools as an overarching educational goal and area of responsibility. This update has come into effect in the 2023/24 school year and emphasises health promotion in schools as an overarching theme (formerly a teaching principle). By addressing health issues in the classroom, pupils should be supported in developing a health-conscious and environmentally responsible lifestyle, promoting their physical and psychosocial well-being [29–33].

Research gap and objective

The analysis of the lifestyle behaviours of different population groups or individuals is crucial to understanding their current and future state of health. Therefore, monitoring the health status of children and adolescents, including various factors that influence health status, is of particular importance in research. Due to a one-dimensional representation, the scientific data on many areas of child and adolescent health is often inadequate. The depiction of certain aspects (current dietary trends or correlations between dietary patterns and physical activity behaviour) has so far been lacking even in large long-term studies, such as the largest European study on child and adolescent health, the HBSC study (Health Behaviour in School-aged Children) [34, 35] or the KiGGS study of the Robert Koch Institute on the health situation of children and adolescents in Germany [36].

The aim of the "From Science 2 School" study was, therefore, to survey the frequencies and distribution of various diets (mixed diet, vegetarian, vegan) in connection with sport and exercise behaviour in the school context (pupils, teachers, principals) for the first time.



Method

"From Science 2 School" was designed as an Austria-wide, cross-sectional study with a multidisciplinary approach using a multi-level cluster sampling strategy. The target groups were all pupils at secondary levels I and II as well as their teachers and school principals, which resulted in a potential sample size of 771,525 children and adolescents and 89,243 adults.

The study was carried out at the University College of Teacher Education Tyrol in the field of sports didactics/sports education as a didactic research project at the Department of Subject Didactics and Educational Research and Development. It was funded by the TWF (*Tiroler Wissenschaftsförderung*), supported by the Austrian Federal Ministry of Education, Science and Research (BMBWF) and approved by all nine Austrian Federal Education Authorities.

The data on the relevant health aspects was collected via an online survey that was active in the 2019/20 school year. The school principals of all secondary levels I and II schools ($n = 2,688$) were contacted by email and invited to participate in the study. The school management received information on the aim and procedure of the study and passed this on to class principals. Detailed information and the questionnaire were accessed via the study website (→ www.science2.school). Participation was possible via smartphone, tablet, PC or laptop during lessons or from home.

A short, standardised online questionnaire was used to collect data on (i) socio-demographic characteristics (nationality, age, sex, federal state, place of residence [urban vs rural], region), (ii) anthropometrics (height, body weight, body mass index [BMI]), (iii) school level (level I or II secondary school) and type of school, (iv) dietary habits (e.g. fruit and vegetable consumption, fluid intake, current diet type), (v) exercise and sport habits (e.g. frequency/week, duration/day, type of activity), (vi) smoking status and (vii) alcohol consumption of the target persons. To increase the reliability of the data, control questions were included in various parts of the questionnaire. Participation in the study was voluntary and anonymous. Answering the questions took about 15 minutes and was based on the participants' self-assessment [37–39].

The data were statistically analysed using SPSS 26.0 (SPSS Inc., IBM Corp., Armonk, NY, USA). The mean value with standard deviation was calculated for continuous data and the prevalence for nominal data. A statistical significance level of $p \leq 0.05$ was defined. Differences in anthropometric characteristics and age according to place of residence (urban or rural), sex, school type, school level, physical activity behaviour and diet were analysed using multivariate analysis of variance (MANOVA). Chi-squared tests were used to assess differences in dietary behaviour and physical activity behaviour in relation to living environment and migration background, differences in dietary pattern (e.g. consumption of fruit, vegetables and fluids), smoking status and alcohol consumption in relation to physical activity and diet type (mixed vs. vegetarian vs. vegan diet) as well as associations between physical activity behaviour and diet [37–39].

Results

A total of 8,845 children and adolescents (pupils) and 1,350 adults (teachers and school principals) across Austria took part in the online survey. Regarding the data of the children and adolescents, power calculations revealed that a minimum sample size of 984 pupils would be required in order to derive statistically reliable, representative results. After examining the raw data, complete and valid data from 8,799 pupils (1.14% of the total sample) and 1,350 teachers and school principals (1.51% of the total sample) were considered for data analysis.

Sociodemographic and anthropometric characteristics

Of the 8,799 participating pupils (average age 15.1 ± 2.3 years), 36.9% were male, 63.1% female, 30.1% attended secondary level I (5th to 8th grade), 69.9% attended secondary level II (9th grade and above), 68.3% lived in rural areas and 31.7% in urban areas. The proportion of female school principals and teachers (average age 45.8 ± 11.4 years) was 69.7%. Of these adults, 62.3% lived in rural areas and 37.7% in urban areas.

75.8% of the pupils had a body weight categorised as normal (according to BMI percentiles). 12.4% of the pupils were underweight, 11.8% were overweight or obese (overweight: 7.1%; obese: 4.7%); boys were more frequently affected by overweight or obesity than girls (15.5% vs. 9.6%) and participants from urban areas more frequently than those from rural areas (13.9% vs. 10.8%, $p < 0.05$). In the adult group, 63.0% were of normal weight, while 34.4% were overweight or obese (overweight: 25.6%; obese: 8.8%). As with the pupils, male participants were more frequently affected by overweight or obesity than female participants (46.5% vs. 29.2%, $p < 0.01$). However, unlike the underage participants, there was a higher prevalence of overweight and obesity among teachers and school principals living in rural areas than among those from urban areas (35.9% vs. 31.3%, $p > 0.05$).

Diet

Regarding dietary patterns, the majority of pupils (84.3%) stated that they ate a mixed diet, 8.5% followed a vegetarian diet and 7.2% a vegan diet. A mixed diet was more common among boys than girls (87.0% vs. 82.8%). A vegetarian diet was more common among



girls (10.7% vs. 4.6%), while more boys than girls followed a vegan diet (8.4% vs. 6.5%). Similarly, mixed diets were also the most common dietary pattern among teachers and school principals (89.3%), whereas 7.9% were vegetarians and 2.9% were vegans. A mixed diet was more common among men than women (93.9% vs. 87.2%), while a vegetarian (9.8% vs. 3.4%) or vegan (3.0% vs. 2.7%) diet was more common among women.

Although a mixed diet was the predominant dietary pattern in both urban and rural areas, relatively more pupils, teachers and school principals living in rural areas followed a mixed diet, while vegetarian and vegan dietary patterns were more common in urban areas.

Vegetarian pupils had the lowest average BMI, but there were no significant differences in the prevalence of overweight between the different diets. However, the obesity rate was significantly lower among vegetarians (2.6%) than among omnivores (4.9%, $p < 0.01$) and vegans (4.9%, $p < 0.01$). Underweight was significantly more common among vegetarians (15.6%) and vegans (15.0%) than among mixed dieters (11.9%, $p < 0.01$).

Among the adult participants, those who ate a mixed diet had a significantly higher BMI ($24.4 \pm 4.0 \text{ kg/m}^2$) than those who were vegetarian ($23.1 \pm 3.2 \text{ kg/m}^2$) or vegan ($22.7 \pm 4.3 \text{ kg/m}^2$) ($p < 0.05$). Although the prevalence of overweight and obesity differed between the various dietary patterns, with higher rates among omnivores compared to vegetarians and vegans, the differences were not statistically significant. However, there was a significantly higher prevalence of underweight among participants who followed a vegan diet (mixed diet: 2.2%; vegetarian diet: 2.8%; vegan diet: 15.4%, $p < 0.01$). ♦ Table 1 shows the weight distribution of the study participants by dietary pattern.

Physical activity and sports

In terms of physical activity behaviour, 82.4% of pupils reported regularly engaging in sports during their leisure time, with 42.5% of them being members of a sports club. On average, the pupils engaged in sports on 2.9 ± 2.0 days per week. Male participants were more likely to participate in both leisure (85.8% vs. 80.5%, $p < 0.01$) and club sports (52.0% vs. 36.6%, $p < 0.01$) and also participated in sports more days per week than females (3.3 ± 2.1 vs. 2.6 ± 1.9 days/week, $p < 0.01$). Additionally, it was noticeable that participation in recreational and club sports decreased with increasing age of the children/adolescents ($p < 0.01$), which was also reflected in a decrease in the number of days per week that young people were active in sports ($p < 0.01$).

There was no difference in physical activity between pupils from rural and urban areas. A significant correlation was found between regular physical activity and a lower prevalence of overweight and obesity ($p < 0.01$).

Among adult participants, the majority (88.7%) also stated that they regularly engaged in sports during their leisure time, but less than a third (29.2%) were active in sports clubs. Adults engaged in sports on average of 2.9 ± 1.5 days per week, with men being more physically active (3.1 ± 1.5 vs. 2.9 ± 1.4 days/week, $p = 0.02$) and participating in sport clubs more often than women (39.1% vs. 24.9%, $p < 0.01$).

Associations between physical activity and body weight were found among adults: engaging in recreational sports was associated with a significantly lower body weight and BMI ($p < 0.01$) resulting in significantly lower overweight and obesity prevalences among leisure-time sports participants compared to "non-sports participants" (32.0% vs. 53.6%, $p < 0.01$). ♦ Table 2 shows the weight distribution of the study participants according to type of physical activity.

Relationships between health-related behaviours

Among pupils, significant correlations were found between leisure-time physical activity and a higher consumption of fruit, vegetables and water ($p < 0.01$). Soft drinks were consumed more frequently by children and adolescents who were less active in their leisure time ($p < 0.01$). Taking age differences into account, alcohol and tobacco consumption was also less prevalent among pupils who regularly took part in recreational sports.

Pupils adhering to a vegan or vegetarian diet were more active in leisure-time sports (vegans: 3.2 ± 2.1 days/week, $p < 0.01$; vegetarians: 2.9 ± 2.0 days/week) than those on a mixed diet (2.8 ± 2.0 days/week). With regard to alcohol, significantly lower con-

| | Secondary Level Pupils | | | Teachers/School Principals | | |
|---------------------|---------------------------|-------------------------|--------------------|----------------------------|-------------------------|-------------------|
| | Mixed Diet (n = 7,421) | Vegetarian (n = 745) | Vegan (n = 633) | Mixed Diet (n = 1,205) | Vegetarian (n = 106) | Vegan (n = 39) |
| Underweight | 11.9 | 15.6 | 15.0 | 2.2 | 2.8 | 15.4 |
| Normalweight | 76.1 | 75.3 | 72.0 | 62.6 | 69.8 | 56.4 |
| Overweight | 7.1 | 6.6 | 8.1 | 25.9 | 23.6 | 20.5 |
| Obese | 4.9 | 2.6 | 4.9 | 9.3 | 3.8 | 7.7 |

Tab. 1: Relative distribution (%) of the weight categories of the study participants by dietary pattern



sumption was observed among vegan pupils at 25.3% compared to non-vegan pupils (vegetarians: 46.3%; mixed diet: 48.8%). However, there was no significant difference in smoking habits between vegans, vegetarians and those on a mixed diet.

Positive correlations between regular leisure-time sports and dietary habits (vegans with higher physical activity over 3.9 days per week vs. those on a mixed diet [2.9 days/week] and vegetarians [3.4 days/week], $p < 0.01$), as well as a higher intake of water, fruit and vegetables ($p < 0.01$), were also observed among teachers and school principals. In contrast to the underage participants, however, those who exercised regularly consumed alcohol more frequently than their less active counterparts. Nevertheless, the smoking rate was lower among those who exercised regularly and even lower with an increased frequency of exercise per week ($p < 0.01$).

In contrast to the children and adolescents, adults showed no significant correlations between the type of diet and the overall engagement in leisure or club sport, regardless of their regularity. Similarly, there were no significant differences between vegans, vegetarians and those on a mixed diet in terms of alcohol and tobacco consumption among the adult study participants. ♦ Table 3 shows the health behaviour of the study participants by dietary pattern.

Discussion

Among the most significant health-promoting factors regarded as meaningful indicators of health are diet and exercise, which hold relevance not only for pupils, teachers and school principals but for the entire population [39, 40]. Lifestyle-centred, de-medicalised health promotion measures are considered essential and a minimum recommendation (e.g. the dual approach "Healthy Eating – Active Living": promoting healthy eating linked with physical activity) to achieve lifelong and sustainable health, thereby enhancing public health [37, 38]. There exists a gap in the literature concerning the relationship between dietary patterns and physical activity behaviour in the school context. To date, there is a lack of information on the prevalence of dietary patterns in the school context, especially among Austrian pupils and teachers/principals in secondary level I and II schools [37–39]. The aim of this school study

was, therefore, to collect data for the first time on the prevalence of traditional (mixed diet) vs. sustainable, plant-based (vegetarian or vegan diet) diets [41–44] in connection with other health-relevant behaviours (exercise and sport, alcohol and tobacco consumption) among pupils and their teachers/school principals, in each case based on large samples.

The main results for pupils in secondary school level I and II are as follows:

- The majority of pupils (84.3%) followed a traditional diet (mixed diet), 8.5% were vegetarian and 7.2% were vegan.
- Vegetarian pupils had the lowest average BMI (BMI percentile: 50.0 ± 30.3 for omnivores; 44.5 ± 30.1 for vegetarians; 51.6 ± 31.7 for vegans) and the lowest obesity rate (4.9% for omnivores; 2.6% for vegetarians; 4.9% for vegans).
- There were significant correlations between physical activity in leisure time and a higher consumption of fruits, vegetables and water ($p < 0.01$).
- Considering age differences, alcohol and tobacco consumption were significantly less prevalent among pupils who engaged in regular leisure-time sports (alcohol consumption: 45.6% vs. 53.0%; smoking: 7.6% vs. 17.3%, $p < 0.01$).
- Vegan and vegetarian pupils were more active in leisure-time sports (86.4% and 83.6%, respectively) compared to omnivores (82.0%).
- Vegans consumed significantly less alcohol (25.3%) than non-vegans (omnivores: 48.8%; vegetarians: 46.3%).

| | Secondary Level Pupils | | | | Teachers/School Principals | | | |
|---------------------|-------------------------------|------------------------------|-------------------------------|------------------------------|-------------------------------|----------------------------|-----------------------------|----------------------------|
| | Leisure-time Sports | | Club Sports | | Leisure-time Sports | | Club Sports | |
| | yes (n = 7,253; 82.4 %) | no (n = 1,546; 17.6 %) | yes (n = 3,083; 42.5 %) | no (n = 4,170; 57.5 %) | yes (n = 1,198; 88.7 %) | no (n = 152; 11.3 %) | yes (n = 384; 29.2 %) | no (n = 662; 70.8 %) |
| Underweight | 12.0 | 14.5 | 11.5 | 12.4 | 2.3 | 4.6 | 1.5 | 3.0 |
| Normalweight | 77.1 | 69.5 | 80.1 | 74.9 | 65.7 | 41.7 | 68.8 | 60.6 |
| Overweight | 6.8 | 8.6 | 5.4 | 7.8 | 24.5 | 34.4 | 23.1 | 26.6 |
| Obese | 4.1 | 7.4 | 3.0 | 4.9 | 7.5 | 19.2 | 6.6 | 9.7 |

Tab. 2: Relative distribution (%) of the weight categories of the study participants by type of physical activity



| | Secondary Level Pupils | | | Teachers/School Principals | | |
|---------------------|------------------------|----------------------|-----------------|----------------------------|----------------------|----------------|
| | Mixed Diet (n = 7,421) | Vegetarian (n = 745) | Vegan (n = 633) | Mixed Diet (n = 1,205) | Vegetarian (n = 106) | Vegan (n = 39) |
| Leisure-time sports | 82.0 | 83.6 | 86.4 | 88.9 | 88.7 | 83.9 |
| Club Sports | 42.5 | 41.9 | 43.5 | 29.8 | 22.6 | 29.0 |
| Alcohol | 48.8 | 46.3 | 25.3 | 82.0 | 74.8 | 87.1 |
| Smoking | 9.1 | 9.0 | 10.9 | 11.3 | 7.8 | 9.7 |

Tab. 3: Relative distribution (%) of the health behaviours of the study participants by dietary pattern

The key findings for teachers/principals at secondary schools level I and II are as follows:

- Among teachers and school principals, the mixed diet was the most common type of diet (89.3%), 7.9% were vegetarian and 2.9% were vegan.
- Individuals following a traditional diet (mixed diet) had a significantly higher BMI ($24.4 \pm 4.0 \text{ kg/m}^2$) than those who were vegetarian ($23.1 \pm 3.2 \text{ kg/m}^2$) or vegan ($22.7 \pm 4.3 \text{ kg/m}^2$). There were higher overweight and obesity rates among omnivores compared to vegetarians and vegans.
- There were significant correlations between regular leisure-time sports and higher consumption of fruit, vegetables and water ($p < 0.01$).
- The smoking rate was significantly lower among those who regularly took part in leisure-time sports (10.1% vs. 17.8%), and it decreased further with increased frequency of weekly exercise ($p < 0.01$). A correlation between leisure-time sports activities and a higher prevalence of alcohol consumption was also observed ($p < 0.05$).

The increased consideration of sustainable health promotion (see the 17 UN Sustainable Development Goals [SDGs], in particular SDG 3: Good Health and Well-being and SDG 4: Quality Education; → www.plan.de/sdg-nachhaltige-entwicklungsziele.html) [45, 46] in the school curricula of the D-A-CH region [22–26, 47] is justified by its high relevance from a societal perspective. There are many studies that investigate the health behaviour of children and adolescents, e.g. the HBSC study, which regularly collects health data from pupils in the 5th, 7th, 9th and 11th grades (including in Austria) [48, 49]. So far, however, there are only a limited number of health reports focusing on teachers [50–53] and school principals [40, 54], mostly based on mental health and stress management in the school setting.

Secondary level pupils

According to the HBSC study from 2017/18, only 19% of all girls and boys in Europe and Canada meet the WHO physical activity recommendations (60 minutes/day) [55], and in Germany, according to the KiGGS Wave 2 study (nutrition study as a KiGGS module), only 22.4% of girls and 29.4% of boys aged three to 17 years [56]. Regarding physical activity behaviour, a slight improvement can be observed among Austrian girls. In 2018, girls exercised on average 3.5 days per week for at least one hour, while according to the new HBSC study for Austria in 2021/22, girls engaged in exercise on average 3.8 days per week and boys on average 4.5 days per week (unchanged) for at least one hour [48, 49]. As children and adolescents get older, they are less likely to meet the WHO physical activity recommendations [49].

In comparison, 82.4% of pupils in this Austria-wide school study stated that they regularly engaged in sports in their leisure time, with 42.5% stating that they were members of a sports club. On average, the pupils participated in sports on 2.9 ± 2.0 days/week. Comparing male and female participants, boys were found to (i) be more physically active per week (3.3 ± 2.1 vs. 2.6 ± 1.9 days/week, $p < 0.01$) and (ii) engage more frequently in both leisure-time (85.8% vs. 80.5%, $p < 0.01$) and club sports (52.0% vs. 36.6%, $p < 0.01$) than girls.

Moreover, it was noticeable, and in good agreement with the Austrian HBSC study, that participation in leisure-time and club sports decreased with increasing age of the children/adolescents ($p < 0.01$), which was also reflected in a decrease in the number of days per week over which young people were physically active ($p < 0.01$) [37].

The HBSC study from 2017/18 further demonstrates that the diets of most adolescents did not align with current recommendations, with one in five adolescents in Europe and Canada affected by overweight or obesity [55]. While the Austrian HBSC study from 2018 classifies 17% of all pupils in grades 5, 7, 9 and 11 as overweight or obese, the new study update (2020/21) revealed that 17% of girls and 25% of boys suffer from overweight or obesity [48, 49].

In comparison, the present school study found that 75.8% of Austrian pupils had a body weight that could be classified as normal according to BMI percentiles (12.4% were underweight), 11.8% were overweight or obese (overweight: 7.1%; obese: 4.7%), with boys more affected than girls (15.5% vs. 9.6%) and participants from urban areas more affected than those from rural areas (13.9% vs. 10.8%, $p < 0.05$) [37].

Furthermore, considering the dietary behaviour of children and adolescents from Europe and Canada, two out of three adoles-



cents do not consume sufficient nutrient-dense foods (e.g. fruit, vegetables, pulses, grains). According to the latest HBSC study, 41–62% of girls and 29–55% of boys (depending on age) eat fruit at least once per day (while 38–71% do not meet the recommendations) and 43–49% of girls and 29–42% of boys eat vegetables at least once per day (i.e. 51–71% do not meet the recommendations) [49, 57, 58]. The Austrian HBSC results show that the number of pupils who eat fruit or vegetables at least once a day has increased. However, simultaneously, the number of pupils consuming sweets daily has also increased [48, 49]. According to the KiGGS Wave 2 study, the prevalence of overweight in German children and adolescents between the ages of three and 17 is 15.4% and the prevalence of obesity is 5.9% [59]. In addition, the EsKiMo II cross-sectional study (nutrition study as a KiGGS module) found that the composition of the quantity and selection of foods consumed by children and adolescents in Germany deviates significantly from the nutritional recommendations for optimised mixed diets (OMK) by the Research Institute of Child Nutrition [60]. In comparison, the present school study shows that less than two thirds of Austrian pupils consume fruit and vegetables every day [37].

Teacher/School Principals

Reports on the health of Austrian teachers [50–52] summarise health-related lifestyles such as exercise, nutrition or smoking under the term "lifestyle" without clearly distinguishing exercise patterns and diet types or trends from other lifestyle factors such as smoking and alcohol consumption. The results of the HBSC Teacher Report 2010 [51, 52] do not establish a connection between physical activity patterns and different dietary habits, nor do they present current dietary trends and types, and they also do not provide information on alcohol consumption. Regarding smoking, the HBSC study showed that teachers have a lower prevalence of daily smoking than the general public (12.6% vs. 23.3%), with most teachers quitting as they age [51, 52]. The results of the present study show that teachers/school principals appear to have a healthier lifestyle (in terms of BMI, exercise patterns, alcohol consumption and smoking) than the general population [51]. This is in good agreement with the WIENGS study, in which Austrian teachers rated their general health as good to excellent [50].

In the present study, teachers and school principals were physically active for slightly less than three days per week on average. With this lower weekly frequency of physical activity compared to current recommendations, it seems less likely (or at least more challenging) to achieve the recommended duration of weekly physical activity required for health benefits. HBSC reports indicate that both female and male Austrian teachers were more active than the general population [51, 52]; however, teachers in previous HBSC reports were less active in leisure time activity than female and male teachers in the present study.

With regard to overweight/obesity, unlike previous studies for teachers/school principals, male teachers exhibited higher levels of obesity and overweight than their female counterparts. This finding is consistent with an Austrian survey of male teachers as part of the HBSC report 2010 [51, 52], in which 60.6% of male teachers had a BMI in the normal range (63% in the pres-

ent study); overweight and obesity were significantly higher among male teachers than among women (40.6% vs. 14.7%). While the proportion of male teachers within the normal BMI range is significantly higher than in the normal-weight general population in Austria (49.8%), this positive trend is also evident in teachers with overweight (29.1% vs. 35.3%) or obesity (8.2% vs. 12.4%) compared to the general population [51, 52]. It can be surmised that while changing dietary patterns and habits affected both genders, negative changes in exercise habits were more common in men, whereas women are known to be more health conscious, which may have led to these differences [61–63].

The results emphasise the importance of paying sufficient attention to the promotion of long-term, healthy lifestyle habits in order to strengthen disease prevention and improve health both at an individual level and, in terms of better health for future generations (public health, child public health), at a societal level.

Particularly among the underage participants, a range of unhealthy behaviours were evident. Improvements should be sought regarding physical activity levels, which are on average below international recommendations, as well as the frequently inadequate intake of fruits and vegetables, and alcohol and smoking behaviour. As for the participating teachers and school principals, they exhibited a healthier lifestyle compared to the general Austrian population [51, 52] concerning exercise habits, diet, alcohol consumption and smoking status, which may be due to the higher level of education and social advantages of these occupational groups. Nevertheless, the unfavourable behaviours of adult participants such as low average activity levels, insufficient fruit and vegetable consumption and frequent alcohol and tobacco consumption should not be ignored, especially considering their influential example for the next generation.

Although sustainable dietary patterns such as vegetarian and vegan diets are becoming increasingly important for the lifestyle of young people ("hip", "cool", "trendy") [14, 15, 20, 64], no data was previously available on the prevalence of current dietary trends among children and adolescents in Austria. Existing data on this topic has been limited to adults. Similarly, the data available on the correlations between different dietary patterns and physical activ-



ity behaviour as well as other health-related behaviours in the school context was limited. The present data emphasises the need for continued efforts to facilitate the choice of a healthy lifestyle for Austrian pupils, teachers and school principals (cf. "making the healthy choice the easy choice"). For teachers and school principals, the level of physical activity does not appear to be linked to a particular diet. However, healthy physical activity behaviour (regardless of dietary pattern or across all three diet types) is strongly associated with a healthier diet in terms of vegetable and fruit consumption [38].

As teachers and school principals are considered role models, educators and influencers for the next generations, more attention should be paid to addressing their unfavourable lifestyle habits identified in the present study (e.g. lower levels of physical activity compared to international recommendations, moderate consumption of fruits and vegetables) [38]. With regard to public health issues for nations such as Austria or the D-A-CH region, promoting health in schools, especially for pupils, teachers and school principals, is therefore not merely a matter of individual concern but a contribution to the education system and the community as a whole [22–26, 37, 38, 40].

"From Science 2 School" was able to address the gap in information regarding dietary and exercise habits of children, adolescents, teachers and school principals for the first time within the school context. Thereby, the interconnectedness of various health-relevant behaviours and the unique expression of specific health-relevant factors is demonstrated. Sampling a large number of participants, representative data on these aspects could be collected, enabling well-founded statements. This study has the potential to make a significant contribution to mapping current social trends and to serve as a basis for further, more in-depth research. Supported by the Austrian curriculum, the school context, with its nine years of mandatory schooling, particularly in secondary levels I and II, provides a promising living and learning setting for promoting healthy behaviours. Therefore, the development of sustainable health literacy with the dual health approach of daily physical activity and sport combined with a healthy diet shall be established as a minimum recommendation for sustainable and lifelong health and well-being.

Conclusion

This study is the first to provide data on dietary habits and patterns (including the prevalence of mixed diets, vegetarian and vegan diets) and exercise habits in the school context, revealing correlations among health-relevant lifestyle factors and everyday behaviours. The findings are intended to serve as a foundation for reflecting on (school-based) exercise and nutrition programmes in order to derive and develop recommendations, possible options for action and concrete measures for health promotion within the school setting. The findings can be used, for example, by decision-makers and multipliers in the health and education sectors, nutrition and sports experts, health professionals, teachers and parents for future interventions and for designing cost-effective, simple and efficient health promotion initiatives in Austrian schools.

Further information and all publications can be found on the official website of the school study: → www.science2.school

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Disclosures on Conflicts of Interest and the use of AI

The authors declare that there is no conflict of interest and that no AI applications were used in the preparation of the manuscript.



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