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Dietary Supplement Use in Young Elite Athletes and School Children Aged 11 to 13 Years: A Cross-Sectional Study Design

Einnahme von Nahrungsergänzungsmitteln bei 11-13-jährigen Nachwuchsleistungssportlern und Schülern: eine Querschnittsstudie

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Summary

› **Objective:** Information about dietary supplement (DS) use in young German athletes beginning their sporting career is scarce and possible differences to their non-athlete counterparts are unknown. Therefore, the purpose of this study was to analyze DS use in young elite German athletes (A) and non-athlete (NA) controls.

› **Method:** During pre-participation examinations, 562 athletes (323m/239f, 11.7±0.6 years) and 69 non-athletes (12m/57f; 12.5±0.5 years) answered a standardized questionnaire analyzing the prevalence of DS use, reasons for intake, and sources of information. Group differences were analyzed with Chi² test (α=0.05).

› **Results:** 14% of A and 20% of NA used DS, with no statistically significant differences between groups (p=0.231). Magnesium (A: 35%; NA: 36%) and calcium (A: 28%; NA: 7%) were the most frequently used minerals. Vitamin C (A: 37%; NA: 36%) and multi-vitamin supplements (A: 40%; NA: 29%) were the most often used vitamins. The main reason for DS intake was for health improvement (A: 77%; NA: 71%). The main information source was cited as their parents (A: 66%, NA: 71%).

› **Discussion:** Young German athletes beginning their sporting career show similar supplementation habits as their non-athletic counterparts. Compared to the literature, prevalence of DS use amongst the observed athletes is low. This is likely to increase with age and growing performance level. Keeping that and possible doping infractions or overdoses in mind, nutritional education should start early in ones sporting career and should include the parents.

KEY WORDS:
Dietary Supplement, Nutritional Supplement, Elite Athlete, Adolescent, Sports Nutrition, Non-Athlete

Zusammenfassung

› **Problemstellung:** Derzeit ist es unklar, wie hoch die Einnahme von Nahrungsergänzungsmitteln (NEM) bei Nachwuchsathleten aus Deutschland zu Beginn ihrer leistungssportlichen Karriere ist und ob sich diese von derer gleichaltriger Nichtsportler unterscheidet. Ziel der Studie war es daher, die NEM-Einnahme in einer Gruppe von Nachwuchsleistungssportlern und Nichtsportlern zu untersuchen.

› **Methode:** Mit Hilfe eines standardisierten Fragebogens wurden 562 Sportler zur Einschulungsuntersuchung in eine Eliteschule des Sports (EdS) (323m/239w, 11.7±0.6 Jahre) und 69 Nichtsportler (12m/57w; 12.5±0.5 Jahre) zu ihrem NEM-Gebrauch, ihren Hauptgründen und Hauptinformationsquellen befragt. Unterschiede zwischen beiden Gruppen wurden mittels Chi² Test berechnet (α=0.05).

› **Ergebnisse:** Es konnte kein statistisch signifikanter Unterschied der NEM-Einnahme zwischen Sportlern (S) (14%) und Nichtsportlern (NS) (20%) festgestellt werden (p=0.231). Unter den Mineralstoffen wurden Magnesium (S: 35%; NS: 36%) und Kalzium (S: 28%; NS: 7%) und unter den Vitaminen Vitamin C (S: 37%; NS: 36%) und Multivitaminpräparate (S: 40%; NS: 29%) am häufigsten konsumiert. Hauptgrund für die Einnahme war die Gesundheitsförderung (S: 77%; NS: 71%) und Hauptinformationsquelle waren die Eltern (A: 66%, NA: 71%).

› **Diskussion:** Nachwuchsathleten weisen zu Beginn ihrer leistungssportlichen Karriere ein ähnliches Supplementierungsverhalten auf, wie ihre gleichaltrigen Nichtsportler. Im Vergleich zur Literatur ist die NEM-Einnahme der Nachwuchsleistungssportler relativ gering, aber vor dem Hintergrund möglicher dopingrelevanter Verunreinigungen und Überdosierungen dennoch relevant. Um eine mögliche Zunahme der Supplementierung mit steigendem Alter und Leistungsstand zu verhindern, sollten Ernährungsbildungsmaßnahmen bereits früh in den Sportalltag integriert und die Eltern miteinbezogen werden.

SCHLÜSSELWÖRTER:
Nahrungsergänzungsmittel, Nachwuchsleistungssportler, Athlet, Jugendliche, Nichtsportler

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Introduction

While news about inadvertent doping through supplementation are still up-to-date (18), the prevalence of dietary supplement (DS) use in athletes remains high (6). Despite the fact of willingly consuming prohibited substances, athletes may face the problem of false labeling or contaminations and with it the risk of positive doping tests (10). Since laboratory tests may not be specific or sensitive enough to detect contaminations (10), the best way to avoid prohibited substance intake is to eliminate or reduce DS use (13, 18). ›

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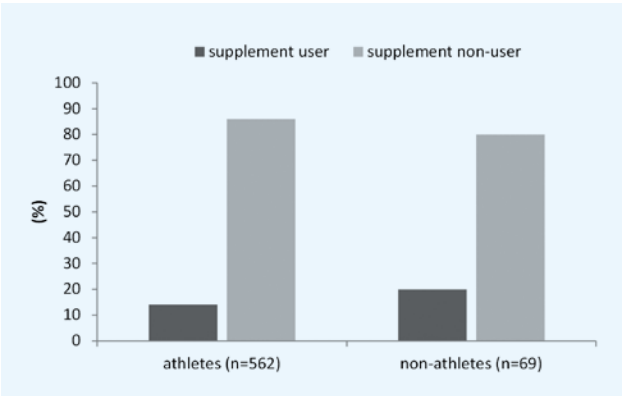

Figure 1

Dietary supplement use in athletes and non-athletes (p=0,231).

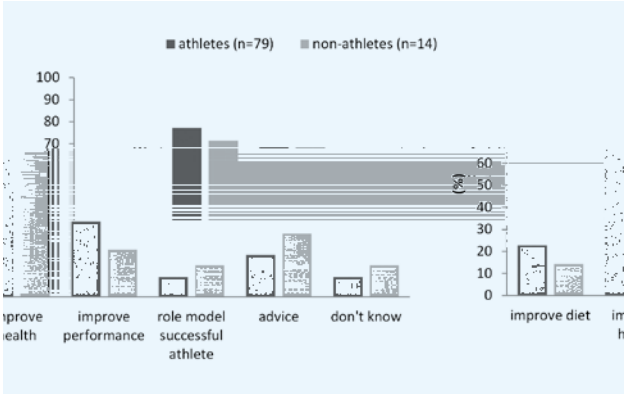

Figure 2

Reasons for taking dietary supplements (DS) in athletic and non-athletic DS users.

The German "Nahrungsergänzungsmittelverordnung" defines a DS as a product, sold in concentrated dosages, i.e. pills, capsules or powders (2). Definitions vary between countries and some studies also include functional foods namely ready-to-use sports or energy drinks (1, 8).

The prevalence of DS use in athletes is high, ranging from 48-91% (1, 6, 12, 15, 19). It is common practice in supplementing athletes to use several supplements at the same time (20, 27) with individual cases reportedly taking up to 17 DS simultaneously (3, 27). Considering the majority of supplementing athletes do not know their supplement's active ingredient, possible side effects, mechanism of action or recommended supplement dosages (5), the high number of DS use is alarming. Athletes may exceed the recommended upper limits of certain nutrients causing potential health problems (3). Despite these possible side effects, intake could also have negative effects on performance. Antioxidants are often advised for athletes due to their higher generation of reactive oxygen species (22, 25). However, growing evidence reveals that athletes have a naturally higher blood antioxidant capacity (4). When these athletes additionally supplement with antioxidants, they inhibit the positive muscular adaptations that normally occur post exercise (11, 21). Given that improved performance is one of the main reasons for consuming DS (1, 12, 20) and the antioxidative vitamin C often supplemented (20), athletes' intentions could conflict with the actual effect of DS use.

There are positive associations between DS use and rising performance level, advanced age and experience in international competitions (1, 8, 9, 26, 28). Only few studies compared the prevalence of DS intake between athletes and non-athletes, but it seems that the tendency of DS use in athletes is greater (26). Furthermore, many studies have only assessed DS intake in adult athletes (8, 17, 28). Information concerning young elite athletes from Germany, especially early in their sporting careers, is scarce. However, to assess potential links between physical activity and supplement use, the prevalence of DS use in non-athletic adolescents needs to be considered as well. To our knowledge, no data is available comparing DS use in young elite athletes to their non-athletic counterparts.

Purpose

This study aims to assess DS use of young athletes at the beginning of their sporting career in comparison to age-matched non-athletes. In detail, prevalence of supplement use, supplement types, reasons for intake and sources of DS information will be assessed.

Methods

DS use was assessed by a standardized nutrition questionnaire developed for the regular medical examination at the University Outpatient Clinic in Potsdam, Germany. First, participants were asked about their general DS use. Secondly, specific classifications (vitamin and/or mineral supplements) were queried. Additionally, using a predefined list of detailed products (Tab. 1), which are reported to be frequently used by German elite adolescent athletes (1), the supplement use of special products was assessed (frequency per week). Other substances, which were used but not listed, could be answered in an open-ended question ("What other dietary supplements do you use?"). According to the German "Nahrungsergänzungsmittelverordnung", ready-to-use sports or energy drinks were not defined as DS (2). Finally, reasons for DS intake and sources of information were questioned.

562 young German athletes of various sport disciplines (323m/239f; 11.7±0.6 years) participated in this study. Data was collected from January 2010 until March 2011 during pre-participation examinations at the University Outpatient Clinic in Potsdam, Germany, before qualifying for one of the four Elite Schools of Sports in the federal state of Brandenburg, Germany.

In addition, 69 non-athletes from a secondary school in Berlin, Germany (12m/57f; 12.5±0.5 years) served as non-athletic controls (data collected in January 2012). While data of athletes was assessed during personal interviews, non-athletes answered written questionnaires during class with an examiner present to explain and respond to questions. Non-athletes participating regularly in sporting competitions were excluded from analysis. The group size of originally 110 non-athletes was reduced by 41 due to missing informed consent (n=11) and participation in competitive sporting activities (n=30). Subjects and their parents provided written informed consent before participation. The study was approved by the scientific board of the University Outpatient Clinic Potsdam, Germany.

Statistical analysis was performed using SPSS 20.0 for Windows (IBM Corp., Armonk, NY, USA). Data are presented as mean ± standard deviation (M±SD). To detect differences in DS intake between athletes and non-athletes, a Chi^2 test was conducted. An α-error of $p<0.05$ was considered statistically significant.

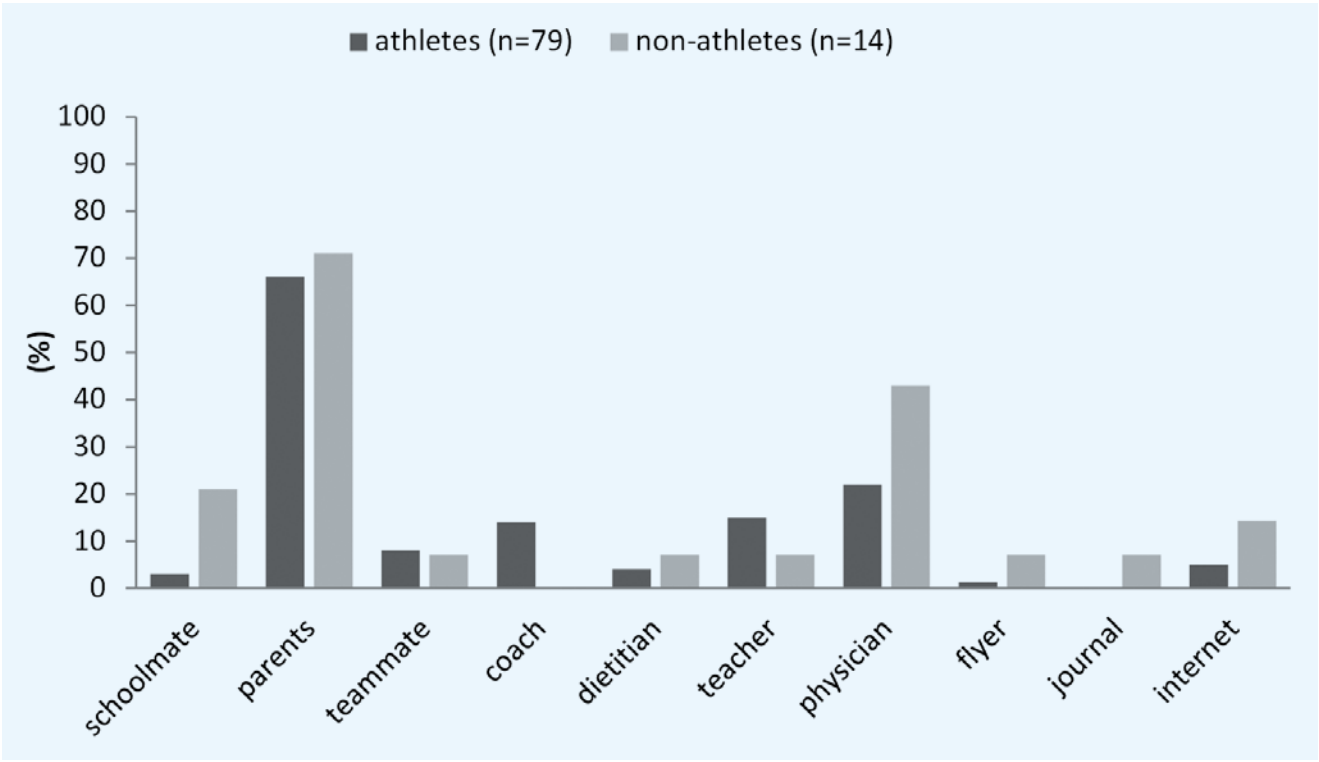

Figure 3

Sources of information about dietary supplements (DS) in athletic and non-athletic DS users.

Results

Overall prevalence of DS use was 14% (n=79) in athletes (A) and 20% (n=14) in non-athletes (NA). There was no statistically significant difference between groups (p=0.231) (Fig. 1).

The reasons for intake, sources of information and specific supplement choice are from DS users only. Additionally, the results could only be described descriptively due to the small sample size. In DS users, magnesium (A: 35%; NA: 36%) and calcium (A: 28%; NA: 7%) were the most frequently used minerals. Vitamin C (A: 37%; NA: 36%) and multi-vitamin supplements (A: 40%; NA: 29%) were the most often used vitamins. Athletes used 2.2±2.0 DS concurrently and non-athletes 1.4±0.8. Other DS not listed, but written in by both groups were: protein powder (n=1 A), zinc (n=2 A; n=1 NA), algae (n=1 A; n=1 NA), vitamin D (n=1 A), probiotics (n=1 A) and fish oil/omega-3 fatty acids (n=2 A; n=1 NA). Detailed information about all products are listed in table 1.

The main reason for DS intake among supplement users was health improvement (A: 77%; NA: 71%), followed by performance improvement (A: 34%) and finally, advice (NA: 29%) (Fig. 2).

Among DS users of both groups, parents were the most often mentioned source of information (A: 66%, NA: 71%), followed by physicians (A: 22%, NA: 43%). 4% of athletes stated a dietitian as their information source (Fig. 3).

Discussion

In the present study, the prevalence of DS use in non-athletes was 20%. This is in agreement with two other German studies in adolescents showing a prevalence of 11% and 20% (23, 24). A similar prevalence was obtained in the participating young athletes (14%), concluding that before entering the German Elite Schools of Sport, young athletes show similar supplementation habits as their non-athletic counterparts. Compared to other studies of elite athletes with a prevalence of DS use from 80-91% (1, 6), DS intake in athletes of the present study is low. Discrepancies between literature and the recent findings regarding DS prevalence may involve the younger age of the athletes observed (11-13 years). In light of an increasing intake with age and rising performance level (1, 9), athletes of the present study may develop a higher prevalence of supplement use with growing training intensities and frequencies. This should be evaluated in further investigations.

Another explanation for DS intake prevalence differences could be the inconsistent definition of the term DS. Some studies include products such as energy or sports drinks into their definition (1, 6, 8), while others do not (19). Therefore, comparison of studies is somehow difficult. In the present study, the definition from the German "Nahrungsergänzungsmittelverordnung" was applied (2), where pre-packed foods and ready to use drinks were not considered as DS. The questionnaire used in the present study was designed to receive a general overview of dietary supplement use and not a detailed analysis of all additional products an athlete might take (e.g. energy drinks, ready-to-use sport drinks). Although the use of these products is generally high in athletes, the prevalence of mineral and vitamin DS intake is greater (1, 6). Therefore, different definitions of DS cannot solely explain the differences in DS intake prevalence. In practice, the distinction between enriched foods with health claims and DS may be difficult for the athlete. In light of possible product contaminations, investigations have also detected prohibited substances in normal herbal teas, claiming to reduce weight (10). Thus, athletes should heed caution with all products claiming to have adventurous health or performance benefits.

Athletes and non-athletes of the present study mentioned their parents as their main DS information source. ›

Table 1

Dietary supplement (DS) use in athletic and non-athletic supplement users (SU).

	ATHLETES (N=79)				NON-ATHLETES (N=14)			
	N	% OF SU	FREQUENCY PER WEEK (M ± SD)	FREQUENCY PER WEEK (MAX)	N	% OF SU	FREQUENCY PER WEEK (M ± SD)	FREQUENCY PER WEEK (MAX)
Vitamin C	29	37	3.0 ± 3.0	14	5	36	5.3 ± 2.9	7
Vitamin E	12	15	3.0 ± 2.0	7	1	7	7	7
Vitamins of B-group	14	18	3.3 ±2.7	10,5	1	7	7	7
Multi-vitamin Supplements	31	39	4.5 ± 4.6	20	4	29	2.6 ± 2.9	7
Magnesium	28	35	2.3 ± 2.5	10,5	5	36	2.2 ± 2.7	7
Iron	9	11	1.6 ± 1.0	3	0	0	0	0
Calcium	22	28	2.4 ± 2.6	10,5	1	7	7	7
Multi-mineral Supplements	16	20	2.7 ± 2.0	7	0	0	0	0
Creatine	4	5	1.5 ± 0.6	2	0	0	0	0

Consequentially, parents should be included in educational programs covering DS use. Major motives for supplement use were health and performance related. This is in agreement with the literature (1, 9, 17), but in spite of that, there is a lack of data connecting the effectiveness of DS with possible health benefits (16). Furthermore potential risks due to over-dosages (14) or lacking evidence regarding the safety in children (7) may counteract these motives.

A major strength of this study is the presence of a non-athletic control group and the large number of athletes included. Many studies have assessed DS use in athletes, but few have a controlled comparison (26). However, in the present study, methods of DS assessment varied between groups (orally vs. written). Although an experienced examiner was present during the survey, a memory or social desirability bias, due to the self-reportage of DS use, could have occurred. Additionally the group size and gender distribution varied between the groups. The small number of supplement users reduced the sample size quite much, which is why the results could not be used for statistical comparisons.

Conclusion

Young German athletes beginning their sporting career show similar supplementation habits as their non-athletic counterparts. In comparison to the literature, prevalence of DS use in the observed athletes is low, but may increase with age and growing performance level (1, 9). Keeping that and possible doping infractions or overdoses in mind, nutritional education programs should start early in a sporting career. Parents, as the main DS information source, should be included in these programs.

Conflict of Interest

The authors have no conflict of interest.

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