

Original Article

Vitamins, minerals and race performance in ultra-endurance runners – Deutschlandlauf 2006

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We investigated the effect of pre-race intake of vitamins and minerals, in the form of supplementation, before a multi-stage ultra-endurance run and their effect on race performance. At the Deutschlandlauf 2006 in Germany, where athletes had to run across Germany from the north (Kap Arkona - Rügen) to the south (Lörrach) over 1,200 km within 17 consecutive stages, twenty male ultra runners (46.2 ± 9.6 years, 71.8 ± 5.2 kg, 179 ± 6 cm, BMI 22.5 ± 1.9 kg/m²) completed a questionnaire about their intake of vitamin and mineral supplements in the four weeks before the race. Race performance of athletes with- and athletes without regular intake of these supplements were compared. In the four weeks before the run, nine runners (45%) ingested vitamin- and twelve athletes (60%) mineral supplements. Athletes with an intake of vitamins (152.8 ± 14.1 h versus 160.6 ± 14.6 h, $p > 0.05$) and minerals (151.6 ± 14.5 h versus 165.3 ± 10.8 h, $p > 0.05$) finished the race no faster than athletes without an intake of vitamins and minerals. We concluded that in the Deutschlandlauf 2006 of over 1,200 km within 17 consecutive stages, athletes with a regular intake of vitamin and mineral supplements in the four weeks before the race finished the competition no faster than athletes without an intake of vitamins and minerals.

Key Words: ultra running - supplementation - nutrition - ergogenic aids - exercise

INTRODUCTION

Nutritional ergogenic supplement use is widespread amongst athletes,¹⁻³ including ultra-endurance athletes.⁴⁻⁶ In numerous studies, no effect from intake of ergogenic supplements in the form of vitamins and minerals has been shown.⁷⁻⁹ Supplementation of vitamins and minerals for weeks does not enhance either anaerobic exercise⁷ or prolonged endurance performance of two hours.^{8,9}

Ultra-endurance athletes use, in addition to rigorous physical training, dietary manipulation as an integral component in order to enhance performance.¹⁰ Little is known about the intake of ergogenic supplements in ultra-endurance athletes.⁵ The aim of our study is to investigate the intake of vitamins and minerals before an ultra-endurance run and their effect on race performance in long distance runners in the longest running event in Germany, the Deutschlandlauf in 2006.

SUBJECTS AND METHODS

Subjects

The organizer contacted all participants of the “Deutschlandlauf 2006” by a separate newsletter three months before the race in which they were asked to participate in the study. Thirty-two runners (28 male and 4 female) started in the run. Twenty-one male and four female runners finished the race within the time limit. Twenty male Caucasian ultra-runners (46.2 ± 9.6 years, 71.8 ± 5.2 kg, 179 ± 6 cm, BMI 22.5 ± 1.9 kg/m²) participated in the study. They all gave their informed written consent. The average training duration of male runners was 14.8 ± 5.5

hours per week varying from six to 27 hours. They had an average experience of ten ultra-endurance races, of 24 hours and longer, prior to the start of the “Deutschlandlauf 2006”, varying from one to 48.

The race

From September 11th to September 27th, the athletes had to run across Germany from the north (Kap Arkona - Rügen) to the south (Lörrach) over 1,200 km within 17 consecutive stages (Table 1). On average, the stages were 70.9 km per day, while the shortest stage was 51.9 km (the 16th) and the longest 93.4 km (the 3rd). Athletes had to run at a speed of at least 6 km/h; otherwise they dropped out of the race. The highest average temperature during the run was 25° Celsius. The weather was stable; in 15 stages the sun was shining and in two stages there were some rain. After each stage, athletes had a break in a small town along the racetrack. The race organizer provided accommodation and nourishment. Athletes, race organizer and support crews were lodged in a gymnasium, hostels or restaurants.

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Table 1. The stages of the “Deutschlandlauf 2006”.

Date	Start of the stage	Finish of the stage	Distance per stage [km]	Cumulative distance [km]
Sept. 11 th	Kap Arkona	Stralsund	64.9	64.9
Sept. 12 th	Stralsund	Stavenhagen	85.4	150
Sept. 13 th	Stavenhagen	Pritzwalk	93.4	244
Sept. 14 th	Pritzwalk	Jerichow	81.6	325
Sept. 15 th	Jerichow	Schönebeck	73.3	399
Sept. 16 th	Schönebeck	Eisleben	66.9	466
Sept. 17 th	Eisleben	Sömmerda	70.5	536
Sept. 18 th	Sömmerda	Ilmenau	80.6	617
Sept. 19 th	Ilmenau	Trappstadt	57.5	674
Sept. 20 th	Trappstadt	Prosselsheim	82.1	756
Sept. 21 st	Prosselsheim	Assamstadt	87.7	844
Sept. 22 nd	Assamstadt	Biberach	72.7	917
Sept. 23 rd	Biberach	Malmsheim	63.0	980
Sept. 24 th	Malmsheim	Horb	55.3	1,035
Sept. 25 th	Horb	St. Georgen	56.1	1,091
Sept. 26 th	St. Georgen	Feldberg	51.9	1,143
Sept. 27 th	Feldberg	Lörrach	62.0	1,205

Breakfast and dinner were served in the gymnasium or in the dining room of the hostels or restaurants. During the night, athletes could sleep either in their sleeping bags in the gymnasium or in a hotel room.

Nutrition during the race

In the morning, the same buffet at breakfast was offered to all runners. It consisted of bread, muesli, jam, eggs, ham, cheese, milk, coffee, tea and fruit juice. During the stages, an abundant buffet with a variety of food and beverages was prepared by the race support crew about every eight to twelve km in order to provide the runners with sufficient food. In the evening at the end of a stage, the same dinner was served for all athletes in the restaurant. Athletes were free to consume their own food and nutrition supplements before, during and after the stages.

Questionnaires

All participants of the race were contacted by a newsletter 3 months before the race by the organizer and received an invitation to fill in their nutritional habits about their intake of vitamin and mineral supplements. Questionnaires were self-administered and not administered by trained personnel. They all gave their informed written consent in accordance with the guidelines established by the Institutional Ethics Committee. No criteria for inclusion/exclusion were used. Athletes were invited to report their intake of all kinds of vitamins and minerals in the form of supplementation (kind of product, dosage) in the four weeks before the race. Apart from an abundant choice of products to mark with a cross, enough space was left for personal remarks. After the race, the completed form was collected from the successful finishers by the race director.

Table 2. Intake of vitamins and minerals in the 4 weeks before the run.

Vitamins †		(%)
Multi-vitamin	6	(30%)
Vitamin E	5	(25%)
Vitamin C	4	(20%)
Vitamin B (complex)	2	(10%)
Folic acid	1	(5%)
<i>No intake of vitamins</i>	11	(55%)
Minerals †		
Magnesium	9	(45%)
Multi-mineral	7	(35%)
Zinc	5	(25%)
Iron	3	(15%)
Calcium	3	(15%)
<i>No intake of minerals</i>	8	(40%)

† Multiple answers are possible when one athlete ingested several products

Statistical analysis

The athletes were separated into successful finishers with intake of vitamin and mineral supplements and without intake of such products before the race. Race performance (total running time) was compared between the athletes with intake and athletes without intake of these substances. Statistical analysis was performed with the R software package (R Foundation for Statistical Computing, Vienna, Austria, 2005). Two-way-analysis of variances (ANOVA) was used to test for significant influence of vitamins and/or mineral supplementation on the total running time. The predetermined level of significance for the study was 0.05.

RESULTS

Distribution of vitamins and minerals

In the four weeks before the run, nine athletes (45%) consumed vitamins and twelve athletes (60%) minerals (Table 2). Five different vitamins were preferred, especially a multi-vitamin product (30%) and vitamin C (20%). Likewise five different minerals were consumed with special

of these male ultra runners (45%) consumed vitamin- and twelve athletes (60%) mineral supplements. This is comparable other studies with ultra runners. In the study by Singh *et al.*⁵ twelve of 17 ultra marathoners (70%) used vitamin and mineral supplements. Peters & Goetzsche⁵ found a supplement intake of 48% in female and 59% in male ultra runners.

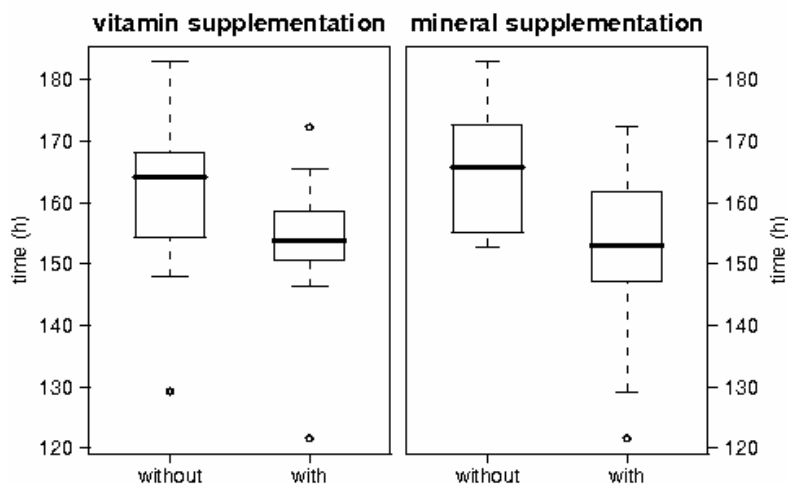


Figure 1. Racing time (box-and-whisker plots with median and interquartile range) of the athletes with or without intake of vitamin and mineral supplements before the race and corresponding race performance. Nine runners consumed vitamin- and 12 athletes mineral supplements whereas 11 runners did not consume vitamin supplements and 8 runners did not ingest mineral supplements.

preference of magnesium (45%) and a multi-mineral product (35%).

Vitamins, minerals and race performance

The successful nine finishers with an intake of vitamins (153 ± 14.1 h) finished the race 7.8 ± 0.5 h faster than the runners without an intake of vitamins (161 ± 14.6 h) ($p = 0.19$). Likewise the twelve runners with an intake of minerals (152 ± 14.5 h) finished the race 13.7 ± 3.8 h faster (165 ± 10.7 h) ($p = 0.06$) (Fig 1). There was a trend that runners with mineral supplementation finished slightly faster ($p < 0.1$).

DISCUSSION

Ultra runners with regular intake of vitamin and mineral supplements in the last four weeks before a multi-stage ultra-endurance run perform no faster than athletes without an intake of these supplements, although the runners with regular intake of vitamins were 7.8 ± 0.5 h faster and the runners with an intake of minerals 13.7 ± 3.8 h faster. But the difference did not reach a statistical significance.

Supplementation with ergogenic vitamins and minerals supplements

Endurance athletes often use other nutritional substances and practices in attempts to obtain a competitive edge by enhancing energy utilization and delaying the onset of fatigue.¹¹ Many athletes are concerned about vitamin and mineral intake and often use nutritional supplements both for security as well as performance reasons.¹² Intake of supplements is widespread in athletes.^{13,14} About 75% of female athletes and 55% of male athletes use supplements.¹⁵ Depending upon the studies, the percentage varies from 6% to 100%.^{4,15-19} In our study, nine

The supplements often taken by athletes include vitamin C, the vitamin B-complex and iron.¹² The trend found with the athletes in this study was the intake of a multi-vitamin product (30%) and vitamin C (20%). Among minerals, magnesium (45%) and a multi-mineral product (35%) were preferred. Some athletes used three and more supplements. This is in accordance to the literature. In some cases up to three different supplements are used.^{13,15,16} Those most often used are combined products^{15,20} followed by minerals, vitamin C, iron, zinc, vitamin E, vitamin B-complex, niacin, folic acid, creatine, concentrates of amino acids, calcium and vitamin A.^{13,16-18,20,21}

Vitamins and minerals and their effect on endurance performance

Numerous nutritional ergogenic supplements have been used in attempts to enhance performance; but with several exceptions' most have been shown to be ineffective.¹¹ There is no evidence that a special nutrient will help elite athletes to perform better. The most important aspect of the diet of elite athletes is that they follow the basic guidelines for healthy eating.²² The use of vitamins and minerals is controversially discussed in endurance performance. Use of vitamin and mineral supplements does not improve measures of performance in people consuming adequate diets.^{12,23} The duration of intake of vitamins and minerals seems to have no effect on performance. Fry *et al.* demonstrated that an eight week supplementation with a liquid multi-vitamin/mineral did not improve anaerobic exercise performance.⁷ However, rates of fatigue on the Wingate Anaerobic Test and the Repeated Squat Test were both significantly improved in the supplemented group. Singh *et al.* supplemented their study participants with a multivitamin-mineral supplement for

twelve weeks. Performance during a 90 min endurance run was not affected.⁸ Weight *et al.* supplemented, also for three months, with a multi vitamin and multi mineral supplement, and running time in a 15 km time trial was not improved.⁹ Obviously neither vitamins nor minerals enhance performance. Fry *et al.*⁷, Singh *et al.*⁸ and Weight *et al.*⁹ supplemented with a multi vitamin and a multi mineral product without effect on performance. And as we can show in addition to the previous literature, the duration of performance is not affected by the intake of vitamins and minerals. Whilst Fry *et al.*⁷ studied the effect on anaerobic performance; Weight *et al.*⁹ investigated runners over a time trial of 15 km and Singh *et al.*⁸ studied ultra runners over a 90 min endurance run.

CONCLUSIONS

In the Deutschlandlauf 2006 of over 1,200 km within 17 consecutive stages, ultra-endurance runners with a regular intake of vitamin and mineral supplements in the four weeks before the run did not finish the race faster than athletes without intake of these supplements. Due to the fact that athletes with vitamin and mineral supplement intake were statistically not significantly faster in the race, we recommend the investigation of the effect of supplementation of vitamins and minerals in controlled field studies in longer races like marathons, 100 km runs and Ironman triathlons. In groups of at least 100 athletes with a controlled ingestion of vitamins and minerals over more than one month, an effect on race performance of the supplementation might possibly result and would be an interesting addition to our understanding.

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AUTHOR DISCLOSURES

The authors Beat Knechtle, Patrizia Knechtle, Ingo Schulze and Götz Kohler, no conflicts of interest.

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極限跑者維生素及礦物質攝取及競賽表現— Deutschlandlauf 2006

本研究想探討在一個多階段極限耐力賽跑前，以補充劑的形式攝取維生素和礦物質的效果和這樣的補充對於競賽上的影響。參加德國 Deutschlandlauf 2006 的運動員都需要從德國北方(Kap Arkona - Rügen)橫跨到南方(Lörrach)，進行超過 1200 公里，17 個連續階段的賽跑。共 20 位男性跑者(46.2 ± 9.6 歲, 71.8 ± 5.2 公斤, 179 ± 6 公分, $BMI=22.5 \pm 1.9 \text{ kg/m}^2$)完成關於比賽前四週攝取維生素和礦物質補充劑的問卷。比較有規律攝取補充劑和沒有攝取補充劑的運動員之競賽表現。賽跑前四週有 9 位(45%)補充維生素和有 12 位(60%)補充礦物質。不管是攝取維生素或礦物質補充劑的運動員完成比賽並沒有比未補充的運動員來得快。所以結論是對於 Deutschlandlauf 2006 超過 1200 公里且 17 個連續階段的競賽而言，比賽前四週有規律攝取維生素和礦物質補充劑的運動員，完成比賽的速度並沒有快過於未補充的運動員。

關鍵字：極限賽跑、補充、營養、增進機能的輔助、運動