Nutritional supplement intake repercussions on the cardio-pulmonary norms and the performance of young students of Sports Science Faculty, Helwan University, Egypt

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Abstract

Optimal athletic performance is strongly related to nutritional practices, especially the consumption of protein-based nutritional supplements among young athletes participating in high-intensity training. Nutritional supplement is commonly consumed by sprinters to aid muscle development and performance. However, the potential effects of nutritional supplement on cardio-pulmonary norms have not been sufficiently investigated, particularly in young athletic populations. Hence, the current study aims to examine the effects of nutritional supplement on cardiovascular parameters, pulmonary function, and sprint performance in young male sprinters undergoing a structured speed training program. A case-control experimental study was conducted with ninety-five male sprinters enrolled in the first and second academic years at the Faculty of Sports Science, Helwan University, Egypt. Participants were divided into a whey protein group (n=45) and a placebo group (n=50). Both groups were followed for a six-month duration, and pre- and post-intervention assessments were conducted, involving resting pulse rate, blood pressure, electrocardiography (ECG), spirometry measurement of total lung capacity, and 100-meter sprint performance. The results revealed that nutritional supplement showed an increased prevalence of transient alterations in resting pulse rate and the appearance of ECG adaptations (mainly an increase in QRS wave amplitude) compared to the placebo group. Moreover, total lung capacity increased significantly in both groups, but there was no significant between-group difference, suggesting the presence of a training-related effect. Moreover, sprint performance had a significant increase throughout the study period in both groups, with a slightly greater increase in supplemented sprinters. Overall, it was concluded that whey protein supplementation in sprint training contributes marginally to performance enhancement and is linked with short- term cardiovascular improvements, while pulmonary improvements seem to be a result of training. These results endorse careful and monitored consumption of nutritional supplement by young sprinters.

Keywords: Nutritional Supplement Intake · Athletes' Performance · Sports Science Faculty · Amino Acids · Cardio-Pulmonary Effects · Sprinters · Speed Training

1. Introduction

Athletic performance is highly affected by nutritional status, specifically the consumption of macronutrients, which aid energy production, muscle function, and recovery (Amawi et al., 2024). Carbohydrates are the main fuel source during high-intensity exercise, followed by fats and proteins (Furber et al., 2021). However, endogenous glycogen and fat stores are also used during exercise if the dietary intake is inadequate. In competitive sports settings, and especially for situations where repetitious high-intensity efforts are performed, such as sprinting, athletes often look for quick-fix strategies to improve performance. This has led to the large use of nutritional supplements, specifically products of protein and amino acids, among young athletes (Baranauskas et al., 2023). Protein supplements, such as nutritional supplement and isolated amino acids, are widely used for promoting muscle development, enhancing strength, and accelerating recovery (Tang et al., 2025). Their popularity is particularly high among university-level athletes and students of sports science, a great number of whom take such supplements without professional supervision and/or sound nutritional awareness (Ficarra et al., 2022; Kaur, 2020). Although the intake of protein is essential for physiological adaptation, excessive or inappropriate supplementation has raised concerns of potential adverse effects on internal organs (Holeček, 2022; Stefanache et al., 2023). Previous studies have suggested that unsupervised use of supplements may have an impact on renal, hepatic, cardiovascular, and pulmonary functions, especially when combined with intense training loads (Adami et al., 2022; Negri et al., 2021).

In recent years, a growing number of studies have been conducted in relation to the cardiovascular and respiratory consequences of nutritional supplement consumption (Łagowska & Bajerska, 2021; Park et al., 2023). Reports of sudden cardiac events occurring during sports activities have led to the need to examine factors related to the intensity of training, supplementation practices, and physiological stress response. As a result, it was noted that amino acid-based supplements have been associated with transient changes in heart rate, blood pressure, and electrocardiographic patterns, particularly in young athletes who are involved in high-intensity training. However, despite these evidences, the findings are inconsistent in the literature, and results differ depending on the type of supplement, dosage, form of training, and population characteristics.

Sprint training induces heavy demands on both the cardiovascular and the pulmonary systems because of the repeated maximal or near-maximal efforts(Satiroglu, 2025). Adaptations to such training may include changes in autonomic regulation, resting heart rate, and ventilatory capacity, which may be further influenced by nutritional interventions (Thurlow et al., 2024). While some studies have examined performance benefits from either protein or amino acid supplementation, relatively few studies have simultaneously investigated the effects of protein or amino acid supplementation on cardio-pulmonary norms and sprint performance within a single experimental framework. Within the Egyptian context, there is a dearth of evidence about the use of supplements, nutritional awareness, and related physiological effects amongst sports science students. This gap is especially apparent in the context of young university sprinters who often integrate structured training with self-directed supplementation practices. Consequently, the current study intends to bridge this research gap by aiming to determine the effect of whey protein supplementation on cardiovascular parameters, pulmonary function, and 100-meter sprint performance of young male sprinters from the sports science faculty at a public sector university in Egypt. The proposed study derives its originality from its integrated evaluation of supplement intake, cardio-pulmonary responses, and athletic performance in a homogeneous population of young sprinters. By integrating clinical cardiovascular assessment, spirometric evaluation, and objective assessment of performance, this research adds to a better understanding of the physiology of whey protein supplementation during speed training.

2. Materials and Methods

This study was performed as a case-control experimental research to investigate the influence of nutritional supplement on the cardio- pulmonary norms and sprint performance of young male sprinters. The study population comprised first and second-year undergraduate male students from the Faculty of Sports Science, Helwan University, Egypt. A total of ninety-five sprinters were examined at the faculty clinic, who were later divided into two groups. The case group consisted of forty-five sprinters who received nutritional supplement, while the control group consisted of fifty sprinters who were given a placebo. Both groups continued their regular sprint training programs during the six-month study period.

The nutritional supplement used in this study was commercially available and taken by many athletes. Every 100 grams of the supplement delivers about 378 calories, 73 grams of protein, 12 grams of total carbohydrates, and 3.1 grams of total fats, including 1.7 grams of saturated fatty acids, 0.85 gram mono- saturated fat, and 0.57 gram poly-unsaturated fat. In addition, there were measurable amounts of cholesterol (12 mg), calcium (364 mg), sodium (424 mg), and potassium (606 mg) in the supplement. Participants in the control group received a placebo in a similar way for the same period of time. Both groups were followed monthly for a six-month follow-up duration to check for adherence to the intake of supplements or placebo and to measure the improvement in sprinting 100 meter/second.

Table 1. Frequency and percentage of participants based on supplement intake.

		Frequency	Percentage (%)
Supplement Type	Nutritional supplement	45	47.36%
	Placebo	50	52.63%
		Mean	Standard Deviation
Supplement Amount		199.5	82.7

Baseline evaluations were done before the beginning of supplementation. Clinical cardiovascular examination involved the measurement of resting pulse rate and blood pressure, as well as cardiac auscultation to evaluate heart sounds. Electrocardiographic (ECG) examination was done to assess the electrical activity of the heart. Pulmonary function testing was performed by spirometry to measure lung volumes, with total lung capacity measured for each participant. Sprint performance was measured by the time it took to perform a standardized 100-meter sprint under similar testing conditions for all the participants. The same clinical measurements were repeated with the same procedures to detect any changes in cardio-pulmonary norms and athletic performance that could be associated with the intake of nutritional supplement. Sprint performance was also assessed on a monthly basis over the study period to assess progression over time. After the intervention, the records from all tests conducted over the 6-month follow-up period were compared to detect the effects of nutritional supplement on cardio- pulmonary norms.

All procedures were performed in accordance with ethical standards of research on human participants. Ethical approval was obtained from the institutional committee of the Faculty of Sports Science, Helwan University, prior to conducting this research. Participants were informed about the purpose and procedures of the research, and informed consent was obtained from all respondents before participation.

Analyses and Results

Supplement Intake

The distribution of research participants based on supplement consumption is presented in Table 1. Of the total study population, 45 sprinters (47.36%) received whey protein supplementation, whereas 50 sprinters (52.63%) were assigned to the placebo group. The mean supplement consumption was 199.5±82.7, indicating regular intake over the study period. This balanced allocation facilitated a reliable comparison between the physiologic and performance-related results between the supplemented and non-supplemented sprinters.

Table 2. Physiological changes in relation to supplement type.

		Nutritional sup.		Placebo		p-value
		No	%	No	%	
Physiological changes	Change in pulse	39	86.7	5	10.0	0.000
	Change in blood pressure	6	13.3	-	-	
	No change	-	-	45	90.0	
Physiological changes duration	A few minutes	42	93.3	5	100.0	0.724
	A few hours	3	6.7	-	-	

The physiological changes related to the intake of supplements are detailed in Table 2, yielding a significant difference between groups with regard to cardiovascular responses. In accordance with the outcomes presented, the majority of the intervention group (86.7%) experienced changes in pulse rate, whereas the remaining participants (13.3%) showed changes in blood pressure. On the other hand, only a minority of the control group (10%) showed changes in pulse rate, whereas the majority of the group (90%) revealed no cardiac changes either in pulse rate or blood pressure. The duration of physiological changes for the majority of the experimental group (93.3%) and the control group (10%) was a few minutes, while for a minority of respondents (6.7%) from the experimental group, the changes lasted for a few hours. Overall, most of these physiological responses were transient in nature as they resolved within a few minutes without any statistically significant difference in duration between groups (p=0.724). These results indicate that the consumption of nutritional supplement is linked to short-term heart rate changes instead of long-term cardiovascular instability.

Table 3. Frequency and percentage of physiological changes based on study groups.

		Nutritional supplement		Placebo		p-value
		No	%	No	%	
Pulse (pre)	Normal 60-120	12	26.7	15	30.0	0.448
	Slow <60	33	73.3	35	70.0	
Cardiac sound (pre)	Normal	45	100.0	50	100.0	-
ECG changes (pre)	Normal	45	100.0	50	100.0	-

Cardiac Changes among Study Groups

Baseline cardiac assessment indicated that in both groups, a large percentage of the participants had resting pulse rates less than 60 beats/min before the intervention (Table 3). Specifically, 73.3% of the nutritional supplement group and 70% of the placebo group yielded slow resting pulse rates with no statistically significant difference between groups at baseline (p=0.448). Moreover, the cardiac auscultation and ECG examination were normal for all the participants before the intervention. However, after the experimental period, following six months of supplementation and sprint training, there were significant differences between the two groups. The prevalence of resting pulse rates below 60 beats/min increased to 80% in the whey protein group in comparison to 62% in the placebo group, showing a statistically significant difference (p=0.044). While heart sounds did not change significantly in either group, post-intervention ECG changes were seen only in sprinters supplemented with whey protein. As indicated in Table 3, 62.2% of these participants had increased QRS wave amplitude, while inverted P waves and ST-segment depression were found in only 2.2% of cases each. No ECG abnormalities were found in the placebo group, hence showing a highly significant difference between the two groups (p<0.001). These results suggest that whey protein supplementation in conjunction with sprint training has a notable influence on cardiac electrical activity, especially QRS morphology.

Pre- and Post-Intervention Comparison of Total Lung Capacity

Changes in the pulmonary functions in terms of total lung capacity are summarized in Table 4. Both groups illustrated significant improvement in total lung capacity after the 6-month intervention period. In the nutritional supplement group, mean total lung capacity increased from 6.0±0.0 L at baseline to 7.689±0.73 L at post- intervention (p<0.001). Similarly, there was an increase from 6.0±0.0 L to 7.690±0.72 L (p<0.001) in the placebo group. Despite these significant within-group improvements, the similarity in post-intervention outcomes between the case and control groups suggests that the enhancements in pulmonary adaptations were the result of the sprint training, instead of the whey protein supplementation.

Table 4. Comparison between pre- and post-intervention total lung capacity in each group.

	Nutritional supplement			Placebo		
	Mean	SD	p-value	Mean	SD	p-value
Total Lung Capacity (Pre)	6.0	0.0	0.000	6.0	0.0	0.000
Total Lung Capacity (Post)	7.689	0.73		7.690	0.72	

Performance of the Whole Study Group

Sprint performance outcomes over the course of 6 months follow-up are shown in Table 5 and visually depicted in Figure 1. Both groups showed a progressive and statistically significant improvement in 100-meter sprint time throughout the study period. In the nutritional supplement group, the mean sprint time decreased from 8.8±1.1 s recorded in the first month to 7.3±0.9 s in the sixth month ($p<0.001$). Correspondingly, in the placebo group, the time improved from 8.8±1.0 s to 7.6±1.0 s over the same period ($p<0.001$). Although performance improvements were observable in both the experimental and control groups, a slightly greater magnitude of improvement was observed in the whey protein-supplemented sprinters, specifically during follow-up months. This trend is visually reinforced by the trajectory of performance in Figure 1, showing that the rate of improvement in sprint time is slightly more pronounced in the nutritional supplement group. These results indicate that although structured sprint training is the dominating factor in the improvement of performance, nutritional supplement may have a small additional effect.

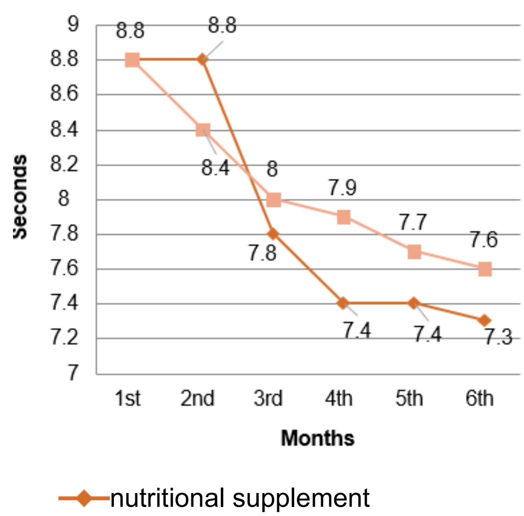

Fig. 1 Line graph showing comparison of performance improvement between the case group and control group in 100-meter sprinting/second throughout the study duration.

3. Discussion and Conclusion

The present study investigated the impact of whey protein supplementation during a 6-month sprint training program on cardiovascular responses, pulmonary function, and sprint performance in young male sprinters. The results suggest that nutritional supplement consumption is linked to temporary cardiovascular adaptations and a small improvement in sprint performance. However, it was also noted that improvements in pulmonary function seem to be the outcome of structured sprint training rather than supplementation alone. The cardiovascular findings of the study are consistent with the existing literature regarding autonomic adaptations associated with training in athletes. The higher prevalence of resting pulse rates of 60 beats per minute after the intervention, especially in supplemented sprinters, is in line with exercise-induced bradycardia, which has been associated with improved vagal tone and greater cardiac efficiency. Similar declines in resting heart rate have been reported with high-intensity or sprint-based training programs in athletes (Lan et al., 2025). The appearance of electrocardiographic changes, which substantially enhanced QRS wave amplitude in the supplemented individuals, is also consistent with the findings of other studies reporting on physiological cardiac remodeling in trained individuals (Banks et al., 2021). These sorts of changes are typically considered benign adaptations associated with increased ventricular mass and electrical conduction efficiency, specifically if there are no related abnormal heart sounds or clinical symptoms.

Table 5. Mean and SD of performance for runners regarding study groups.

	Nutritional supplement			Placebo		
	Mean	SD	p-value	Mean	SD	p-value
1st Month	8.8	1.1	0.000	8.8	1.0	0.000
2nd Month	8.8	1.1		8.4	0.9	
3rd Month	7.8	1.1		8.0	0.8	
4th Month	7.4	0.9		7.9	1.0	
5th Month	7.4	0.9		7.7	1.0	
6th Month	7.3	0.9		7.6	1.0	

In contrast, the results of the present study in terms of pulmonary findings are different from some reports demonstrating supplementation-related improvements in respiratory parameters (Łagowska & Bajerska, 2021). While it is known that amino acid or protein supplementation can improve pulmonary outcomes in elderly or clinical populations (Engelen et al., 2007; Jonker et al., 2017), the fact that the supplemented and placebo groups showed no difference in the current study signifies that the levels of nutritional supplement do not have an independent effect on lung volume in young, healthy sprinters. The similar enhancement in total lung capacity seen in both groups is consistent with past studies suggesting that exercise training per se is the major stimulus for pulmonary adaptation in athletic populations (Dominelli & Sheel, 2024; Rivera-Brown & Frontera, 2012).

In the current study, sprint performance improved significantly during the six-month follow-up period in both groups as a result of effective training-induced adaptation. However, the marginally greater improvements detected in sprinters supplemented with nutritional supplement are consistent with studies that indicate that protein intake may support muscle recovery and training adaptation rather than directly improving speed (Witard et al., 2025). These results reinforce the idea that nutritional supplementation can act as an additional support that might elevate but not entirely replace the physiological effects of systematic training. All in all, the results of this study offer an understanding of the interaction of nutritional supplement supplementation with sprint training in young athletes. The findings indicate that supplementation may have some impact on cardiovascular adaptations and small performance improvements, but pulmonary improvements are mostly training-dependent. Besides, the research did not identify any clinically significant adverse pulmonary or cardiovascular effects throughout the study duration, which implies the short-term safety of nutritional supplement if consumed under controlled conditions.

In spite of its potential contributions, the present study complies with a number of limitations that should be acknowledged. First, the study took place in one academic setting and involved only male sprinters, which could possibly restrict the generalizability of the results to other athletic groups, females, or different age groups. Second, the evaluation of cardiovascular responses was based on the measurement of resting values and conventional ECG assessment without continuous monitoring, and the availability of advanced imaging techniques. Finally, the study did not examine long-term results beyond six months or the effects of differing dosages of protein. Consequently, it has been recommended that future research works should attempt to address these limitations by including larger, more diverse athletic populations, as well as using longitudinal research designs with extended follow-up periods. The implementation of specific advanced applications of cardiovascular assessment tools and biomarkers could offer more in-depth insights into the mechanisms involved in supplementation-related adaptations. Lastly, further studies involving comparisons of various types and doses of protein supplementation may also be useful in elucidating optimal nutritional strategies for sprint-based athletic performance.

References

1. Adami, P. E., Koutlianos, N., Baggish, A., Bermon, S., Cavarretta, E., Deligiannis, A., Furlanello, F., Kouidi, E., Marques-Vidal, P., Niebauer, J., Pelliccia, A., Sharma, S., Solberg, E. E., Stuart, M., & Papadakis, M. (2022). Cardiovascular effects of doping substances, commonly prescribed medications and ergogenic aids in relation to sports: A position statement of the sport cardiology and exercise nucleus of the European Association of Preventive Cardiology. European Journal of Preventive Cardiology, 29(3), 559-575. https://doi.org/10.1093/eurjpc/zwab198.
2. Amawi, A., AlKasasbeh, W., Jaradat, M., Almasri, A., Alobaidi, S., Hammad, A. A., Bishtawi, T., Fataftah, B., Turk, N., Al Saoud, H., Jarrar, A., & Ghazzawi, H. (2024). Athletes' nutritional demands: A narrative review of nutritional requirements. Frontiers in Nutrition, 10, 1331854. https://doi.org/10.3389/fnut.2023.1331854.
3. Banks, L., Al-Mousawy, S., Altaha, M. A., Konieczny, K. M., Osman, W., Currie, K. D., Connelly, K. A., Yan, A. T., Sasson, Z., Mak, S., Goodman, J. M., & Dorian, P. (2021). Cardiac remodeling in middle-aged endurance athletes: Relation between signal-averaged electrocardiogram and LV mass. American Journal of Physiology-Heart and Circulatory Physiology, 320(1), H316-H322. https://doi.org/ 10.1152/ajpheart.00602.2020.
4. Baranauskas, M., Kupčiūnaitė, I., & Stukas, R. (2023). Dietary intake of protein and essential amino acids for sustainable muscle development in elite male athletes. Nutrients, 15(18), 4003. https://doi.org/10.3390/nu15184003.
5. Dominelli, P. B., & Sheel, A. W. (2024). The pulmonary physiology of exercise. Advances in Physiology Education,

48(2), 238-251. https://doi.org/10.1152/advan.00067.2023.

6. Engelen, M. P., Rutten, E. P., De Castro, C. L., Wouters, E. F., Schols, A. M., & Deutz, N. E. (2007). Supplementation of soy protein with branched-chain amino acids alters protein metabolism in healthy elderly and even more in patients with chronic obstructive pulmonary disease. The American Journal of Clinical Nutrition, 85(2), 431-439. https://doi.org/10.1093/ajcn/85.2.431.
7. Ficarra, G., Rottura, M., Irrera, P., Bitto, A., Trimarchi, F., & Di Mauro, D. (2022). Use of drugs and dietary supplements in university students of sports science: results of a survey-based cross-sectional study. Nutrients, 14(20), 4267.https://doi.org/10.3390/nu14204267.
8. Furber, M., Pyle, S., Roberts, M., & Roberts, J. (2021). Comparing acute, high dietary protein and carbohydrate intake on transcriptional biomarkers, fuel utilisation and exercise performance in trained male runners. Nutrients, 13(12), 4391. https://doi.org/10.3390/nu13124391.
9. Holeček, M. (2022). Side Effects of Amino Acid Supplements. Physiological Research, 71(1), 29-45. https://doi.org/10.33549/physiolres.934790.
10. Jonker, R., Deutz, N. E., Erbland, M. L., Anderson, P. J., & Engelen, M. P. (2017). Effectiveness of essential amino acid supplementation in stimulating whole body net protein anabolism is comparable between COPD patients and healthy older adults. Metabolism, 69, 120-129. https://doi.org/10.1016/j.metabol.2016.12.010.
11. Kaur, R. (2020). Influence of Sports Dietician on the Nutritional Knowledge and Status of College Athletes (Doctoral Dissertation, Punjab Agricultural University, Ludhiana).
12. Łagowska, K., & Bajerska, J. (2021). Probiotic supplementation and respiratory infection and immune function in athletes: systematic review and meta-analysis of randomized controlled trials. Journal of Athletic Training, 6(11), 1213-1223. https://doi.org/10.4085/592-20.
13. Lan, Y., Wu, Y., Chen, J., Zhou, W., & Tian, S. (2025). Energy metabolism characteristics of sprinters in speed endurance Satiroglu, R. (2025). The acute and chronic effects of exercise intensity and rest duration on physiological responses during 4-second sprint interval exercise (Doctoral Dissertation, The University of Texas at Austin). https://doi.org/10.26153/tsw/60811.
14. Stefanache, A., Lungu, I. I., Butnariu, I. A., Calin, G., Gutu, C.,
15. Marcu, C., Grierosu, C., Goroftei, E. R. B., Duceac, L.- D., Dabija, M. G., Popa, F., & Damir, D. (2023). Understanding how minerals contribute to optimal immune function. Journal of Immunology Research, 2023(1), 3355733. https://doi.org/10.1155/2023/3355733.
16. Tang, C., Xi, T., Zheng, J., & Cui, X. (2025). Chemical Properties of Whey Protein in Protein Powders and Its Impact on Muscle Growth in Athletes: A Review. Natural Prod uct Communications, 20(3), 1934578X251326124. https://doi.org/10.1177/1934578X251326124.
17. Thurlow, F., Huynh, M., Townshend, A., McLaren, S. J., James, L. P., Taylor, J. M., Weston, M., & Weakley, J. (2024). The effects of repeated-sprint training on physical fitness and physiological adaptation in athletes: A systematic review and meta-analysis. Sports Medicine, 54(4), 953-974. https://doi.org/10.1007/s40279-023-01959-1.
18. Witard, O. C., Hearris, M., & Morgan, P. T. (2025). Protein nutrition for endurance athletes: A metabolic focus on promoting recovery and training adaptation. Sports Medicine (Auckland, NZ), 55(6), 1361. https://doi.org/10.1007/s40279-025-02203-8.
19. training with different intermittent rest periods. Scientific Reports, 15(1), 34209. https://doi.org/10.1038/s41598-025-15774-3.
20. Negri, A., Townshend, H. D., & Corazza, O. (2021). Untested Supplement Use Among Athletes: An Overlooked Phenomenon?. In Emerging Drugs in Sport (pp. 33-45). Springer International Publishing, Cham. https://doi.org/10.1007/978-3-030-79293-0_3.
21. Park, H. Y., Kim, S. W., Seo, J., Jung, Y. P., Kim, H., Kim, A. J., Kim, S., & Lim, K. (2023). Dietary arginine and citrulline supplements for cardiovascular health and athletic performance: A narrative review. Nutrients, 15(5), 1268. https://doi.org/10.3390/nu15051268.
22. Rivera-Brown, A. M., & Frontera, W. R. (2012). Principles of exercise physiology: responses to acute exercise and long-term adaptations to training. PM&R, 4(11), 797-804. https://doi.org/10.1016/j.pmrj.2012.10.007.