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A Systematic Review of the Impact of Vegan and Plant Based Diets on Sports Performance of Athletes

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Abstract: *The current study investigated the impact of vegan and plant-based diets on sports performance of athletes. The goal was to analyze the data from previous studies to determine the collective position of the impact of vegan and plant-based diets on athletes. The research adopted a secondary approach and collected data from already conducted studies. A systematic review following the guidance of PRISMA was conducted and studies numbering 30 in total were selected for the review. Different databases were accessed to enable the sourcing of data files and research on the subject matter including but not limited to PubMed, ProQuest, NCBI, Cochrane, Google Scholar, Web of Science. The inclusion criteria allowed studies done in the last 10 years, and it was mandatory that consulted studies has empirically tested the performance of athletes and dietary effect on the same. There are conflicting findings in research regarding the impact of vegan and plant-based diets on performance of athletes with some research indicating that vegan and non-vegan athletes had minimal differences in performance, while some indicating that vegan and plant-based diet athletes suffer performance challenges especially during high endurance and intensity sporting activities. The current study resolves this misunderstanding by providing clarity on the impact of vegan and plant-based diets on sports performance of athletes. Some of the impacts noted included the lack of strength and endurance, as well as muscle depletion especially due to lack of certain nutrients in their diets. The research reviews some of the nutrients and provides recommendations for supplementation of these nutrients for the improved performance of vegan and plant-based diet athletes.*

Keyword: Vegan diet, vegetarian athletes, performance, plant-based diet

INTRODUCTION

There is a considerable rise in notions of vegan and plant-based diets as an alternative to the omnivorous diet and feeding habits. These notions are gaining traction owing to the increasing understanding that vegan and plant-based diets offer better health benefits as compared to non-vegan diets [1]. The foregoing notwithstanding, a review of the subject area in research repositories points to a rapidly developing field of knowledge where many truths are yet to be discovered which underscores the importance of the current research to help improve the area

of knowledge. In drumming support for the health benefits of vegan and plant-based diets, concurrent research indicates that, these diets promote low lipoproteins and therefore low cholesterol among individual, reduced risks of heart diseases, type II diabetes, cancer and blood pressure [2]. Opponents of the blanket assumption that vegan and plant-based diets are better compared to non-vegan diets due to the above advantages on the other hand intimate that vegan and plant-based diets lack numerous critical nutrients that are needed in the body [3]. It is noted from evidence therefore, that purely vegan diets deprive the individual of direly needed proteins, and this ends up affecting metabolic activity leading to inherent weakness especially when considering athletic individuals.

The foregoing in despite, it is noteworthy that, owing to the rallying calls that people adopt a more ethical approach towards animal welfare, a number of athletes have in the recent past openly advocated for veganism indicating that they have made a change of lifestyle from non-vegan diets to vegan and plant-based diets [4-5]. On the other hand, there is an increase of vegan sports competitors in the international stage competitions whose performance has been noted to be no lesser than that of non-vegan athletes, pointing out the question of the need to adopt vegan and plant-based diets by athletes [6]. This has led to studies to support the development of dietary combinations that can help vegan athletes perform exemplary well so as the debunk the myths surrounding vegan diets as an enabler of all rounded quality of life – with athletics as the prism. Overall, however, it can be noted clearly that most of the push towards vegan and plant-based diets has little to do with the need to have vegan and non-vegan athletes compete, rather, as noted from evidence of research, the rallying calls are supported by animal rights lobby groups and activists [7]. Vegan athletes have been subject to stigma, negativity and stereotyping and this is why there is a growing need to highlight the capabilities of vegan athletes to compete in the global stage and with that, realize the goal of convincing the masses on the animal welfare agenda to ensure better animal rights through a largescale adoption of vegan and plant-based diets.

Concurrent evidence of research indicates that athletics remains one of the areas that can effectively test the dietary fitness of an individual [8]. In other words, an athlete's diet is likely to affect their performance and mental form and, in that light, therefore, understanding the distinction between vegan athletes and non-vegan athletes, or the impact that vegan diet has on an athlete as distinguished from a non-vegan diet is critical. This understanding can help improve the vegan diet and plant-based diets discourse in the athletics field by pointing out the dietary deficiencies of a vegan diet so that supplementation can be done in order to bring forth athletes of well nutrition. This provides an impetus for the current systematic review of literature. The review is suitable for coaches and dieticians and trainers who may want to improve the performance of their vegan athletes.

In this review of literature, the research will seek to:

1. Investigate the dietary requirements for an all-rounded athlete and interrogate that from the vegan and plant-based diets perspective.
2. Provide directions and guidelines of what is needed for a well-nutritioned athlete and how the vegan diet can be tailored to ensure this.

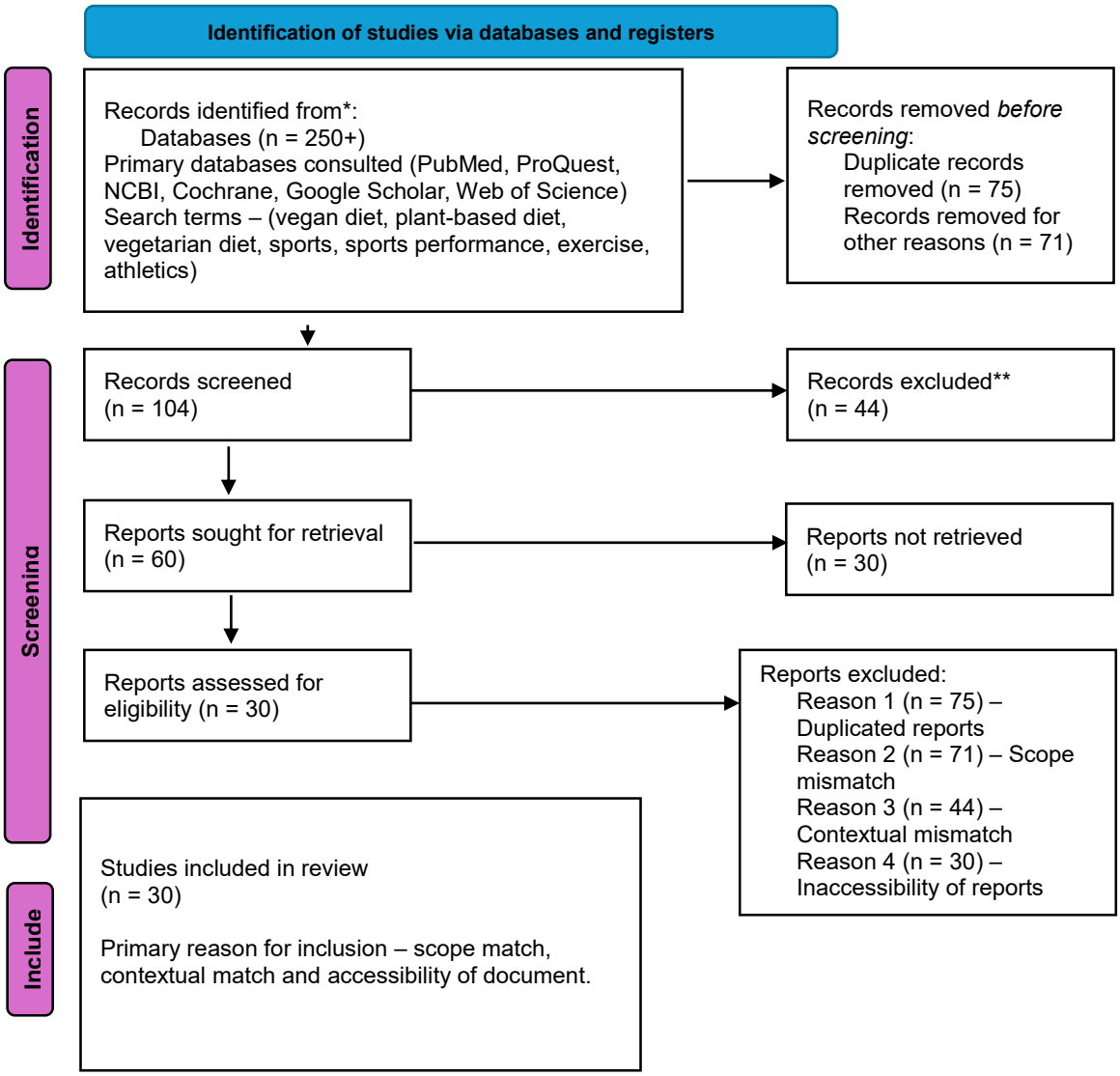
METHODS

The current study conducted an extensive review of evidence of literature on vegan and plant-based diets and their impact on sporting health. The research applied to PRISMA protocol to

source and funnel down sources to retain the most relevant and informative sources from the numerous sources in the field. Different databases were accessed to enable the sourcing of data files and research on the subject matter including but not limited to PubMed, ProQuest, NCBI, Cochrane, Google Scholar, Web of Science. A total of 30 studies were identified as fitting for the current review with the rest being considered as deviant from the subject matter of the study and/or the inclusion and exclusion criteria of the study. The main keywords that were used in searching for studies covering the subject were vegan diet, plant-based diet, vegetarian diet, sports, sports performance, exercise, athletics. These search terms were introduced to the search engines bearing multiple variations such as “vegan diet impact on sports performance”, “exercising effect on vegetarians” – among others.

The research had a focus on articles published within the last 10 years and therefore, the last year of consideration for articles was 2014. Together with the foregoing, all articles had to be in English and have tested or extensively examined the performance effect of diets on athletes. Comparative study articles within the period and in English were considered very important sources of information. The sourcing of articles also considered not the methodological approach and was open to include empirical as well as secondary research approaches. The search was conducted between November 2023 and May 2024 and all articles gathered within this period were considered for use in the current research.

Below is the PRISMA protocol table detailing the identification of sources for the current review:-



*Consider, if feasible to do so, reporting the number of records identified from each database or register searched (rather than the total number across all databases/registers).
**If automation tools were used, indicate how many records were excluded by a human and how many were excluded by automation tools

Equity, diversity and inclusion

The current study included a consideration of the effect of vegan and plant-based diets on both male and female athletes without discrimination. The identification and selection of literature was not limited to any regions or designed to overlook research from any particular geographical locations. The research included information from a host of male and female researchers on the subject matter to understand their disparate perspectives on the matter thereof. The research also endeavored to discuss the findings from extant literature without bias and preference or anything to suggest non-inclusivity.

LITERATURE REVIEW

One of the criticisms against vegan and plant-based diets in athletics has been that it is not all rounded may thus, lead to malnutrition of the athlete [9-10]. According to the evidence in the foregoing cited research [10], vegan and plant-based diets despite having a raft of benefits to the human body, are deficient in key nutrients that can help support an athlete's functionality and activities. While the foregoing observation has over the recent past been disrepute with

increasing research on vegan and plant-based diets benefits indicating the advantages of the same, it is evidence even from recent evidence of research that there is still some nutritional deficit that vegan diets hold [11, 9]. Researchers indicate that, vegan and plant-based diets have their advantages, however, in the case of athletics, vegan and plant-based diets cannot operate without proper dietary design which includes supplementation to fill in for the missing nutrients. This case is also supported and further elaborated upon to enlighten that, poorly designed and vegan diets are known to predispose athletes and vegans in general to macronutrients (n-3 and protein), as well as micronutrients (vitamins D and B12, including iron, iodine, zinc and calcium) [9]. The foregoing nutrients and minerals are of particular importance especially owing to the fact that animal-based nutrients are unavailable when considering a vegan diet.

Proponents of vegan and plant-based diets and its efficiency in supporting human metabolic activities indicate in opposition to the above that, plant-based diets contain certain nutrients that can help in effective exercise and athletic performance [12]. For instance, antioxidants (polyphenols) and vitamin C and E micronutrients have been suggested by scholars to be potential performance enhancers coupled with carbohydrate rich plant-based foods which can improve training and recovery. The foregoing notwithstanding, evidence of empirical research backing up the above observation remains lean or equivocal. While the recent past has seen a growing body of literature focusing on veganism and its effect on athletics performance, which include comparative trials between vegan and non-vegan athletes, it is critical to note that this remains a rapidly growing body of literature and further technical tests will need to be done to ascertain the superiority of one diet over the other, or ascertain the specific nutritional elements present in one over another that lead to a difference in performance. The present research notes the foregoing gap in literature, which can explicitly be mentioned as the lack of research that specifically highlights the nutrients present in vegan and plant-based diets that enhance performance over the non-vegan diets. It is however generally accepted that vegan diets have numerous other health benefits as earlier mentioned and cited [2].

Noteworthy also at this juncture is the fact that, from currently available research on the comparative impacts of the two distinct diets (vegan and non-vegan) impact on athletes performance, there is evidence that the difference is marginal with some researches showing that vegan athletes had more endurance compared to their non-vegan counterparts, while others favoring the latter [12, 13]. The cited evidence of research agreeably accentuate the discrepancy in the assessment of the distinction between vegan and plant-based diets impact on athletes' performance as compared to non-vegan, and the equivocal nature of current research in the field. In the former evidence, athletes using vegan and plant-based diets were found to have more endurance, while in the later, it was noted that there is minimal difference between the performance of vegan or non-vegan athletes, with each of the dietary options having its on set of advantages and disadvantages. In the current study therefore, for the benefit of improving the understanding of the vegan and plant-based diets, focus will be placed on highlighting how vegan and plant-based athletes may achieve macro and micronutrients necessary to enable their wholesome nutritional capabilities to enhance their exercise and athletics activities. Certain themes will therefore be discussed notable – energy, micro and macro-nutrients and supplements, that can assist in improving the performance of vegan and plant-based diet athletes.

Energy

Energy needs to be balanced to provide sufficient training, exercise and/or performance capacity [14]. Energy during athletic activity or during any other activity in a human being is

a function of diet. It is therefore imperative that a well-constructed diet be provided to athletes as this ensures that they have the requisite levels of energy balance to be successful in their daily activities. Concurrent evidence of research indicates that, while energy balance is necessary, the process of exercise, especially in the case of endurance athletics, it is normal to have negative energy balance because the body is enduring the athletic activities [15]. According to West et al. (2023), this is unlike the case of non-endurance-based exercise or athletics activities like simple aerobics. Researchers are in agreement that understanding the energy dynamics based on the sporting activity in question is very critical to athletes, coaches, trainers and dieticians [14-15]. This is because it has a bearing on the health of the individuals and requires proper dietary preparations. For instance, big-bodied athletes are likely to have a difficult time achieving energy balance whether during endurance or non-endurance-based exercises. This is due to the need for more caloric diets to support their bodily energy requirement during exercise. When considering the foregoing in light of the research's focus on vegan and plant-based diet and their impact on sports performance of athletes, it can be deductively noted that, vegan and plant-based athletes with big body mass, stand a higher chance of lacking energy required to participate in high volume sporting activities. This implies that there should be proper planning to ensure that the diet, is sufficient as far as providing the athlete with the necessary energy requirement is concerned.

Further evidence of research highlights the consequences of energy deficiency. According to the evidence, one of the outright consequences of lack of energy especially for athletes is the lack of immunity, which may easily lead to sicknesses of varied nature [16]. The ripple effect of the foregoing in the context of training is that there will be more time off from training which will mean less participation in the sporting activity. This can also degenerate into weight loss, lower work capacity, reduced muscle strength and overall incapacitation during training. Concurrent evidence from researchers when contributing to further understanding of the importance of energy indicated that, vegan and plant-based diets tend to provide early satiation and reduced appetite [17]. To this end therefore, when sporting performance is brought into the picture, it is likely that the vegan and plant-based diet athletes can be first to fall culprit of energy deficiency. This implies that, for vegan and plant-based athletes, there is need to focus on caloric diets that can help boost the energy levels during sports performance and ensure an energy balance. This underscores the opening observation of the current section of the research, which highlighted the importance of energy balance during endurance or high-volume sporting and training activities.

The above is buttressed by evidence of research which indicates that vegan and plant-based diet individuals tend to consume less energy as compared to non-vegan individuals [18]. Data indicates that vegans, comparative to non-vegans, tend to consume less energy in their meals. A general look at vegetarian meals confirms the above by highlighting that a standard vegetarian meal would usually be low in certain nutrients including but not limited to fat, protein, vitamin D, riboflavin, vitamin B12 among others. When considering the above in the context of the knowledge gained herein of the importance of energy in the place of sports performance, it can be stated therefore, that while vegan and plant-based diets seem ethical and better compared to non-vegan, they lack the energy requirement needed for sporting activities and in this light therefore, may at time lead to poor performance if not properly curated.

Micro and Macronutrients

Understanding the micro and macronutrients requirements for athletes and sports professionals can help in interrogating the sufficiency of plant-based and vegan diets as far as providing the individuals with the nutrients is concerned. One of the disadvantages of vegan and plant-based

diets was that it was not capable of providing sufficient micronutrients support to the consumer [10]. The micronutrients which are critical for human development and known to be missing in plant-based diets have been sampled to include – vitamins B12, zinc, calcium, iodine, vitamin D among others. It is therefore advisable that, in designing vegan and plant-based diets for athletes, these nutrients should be considered, and effort must be made to source them [10]. Concurrent evidence of research indicates that maintaining certain micronutrients levels in the diets of athletes assists in ensuring that athletes are prepared for the activities they undertake [19]. To this extent therefore, the food choice should be guided by an understanding of the requisite levels of vitamins, minerals and nutrients and this allows the athlete to be on optimum performance. The lack of micronutrients can lead to poor performance because the body is unable to chemically provide for the activities of the athletes. Reviewing some of the nutrients in further detail can help clearly paint the picture of the importance of the nutrients to the athletes.

Considering for instance, vitamin B12, evidence of research indicates that it is an important nutrient that supports blood and neural functionality [20]. Vitamin B12, otherwise known as cobalamin is a critical actor in the nervous system functionality including DNA synthesis. It is found in animals and non-vegans usually consume it as a pre-formed nutrient from the animal diets. On the other hand, research is equivocal on whether there are any other known sources of vitamin B12 especially in plants [21]. Owing to the critical role that vitamin B12 plays in the human body, prolonged lack of nutrients can spell danger and disaster for any individual – athlete or not. Research notes that hematological and neurological symptoms are common among vegan and plant-based diet individuals for the prolonged lack of vitamin B12 in their diets [22]. The lack of vitamin B12 results in symptoms including but not limited to muscle loss due to dysfunctional morphology of the blood cells. Earlier research supports the foregoing postulations mentioning that, in a study of the United Kingdom vegan population, over 50% of them were found to be vitamin B12 deficient [23]. Over 25% of the same population indicated to be taking vitamin B12 supplements and it was noted polemically that despite taking the supplements, the deficiency levels of vitamin B12 between the ones taking supplements and the ones not, was almost similar. This highlights the challenge of acquiring vitamin B12 through supplements. However, research notes that for athletes, consuming specifically curated fortified foods that have vitamin B12 (e.g fortified whole meal cereals) can help in ensuring that their vitamin B12 thresholds are in check [21-24].

Another nutrient of importance is iron which is essential for the oxygen distribution in the body through the regulation and strengthening of the red blood cells. Evidence of research indicates that it is an important nutrient for sporting professionals as it is closely tied to the endurance capabilities of sports personalities [25]. Hinton intimates that the impact of iron in endurance of athletes is indubitable as it helps in ensuring that the athletes are well oxygenated and that the brain receives sufficient oxygen. Concurrent research indicates that the lack of iron in an individual leads to conditions such as anaemia which means the reduction in the red blood cells [24]. The resultant effect of the above is that an individual feels tired and drowsy, experiences reduced exercise tolerance and can actually suffer shortness of breath. It is therefore advisable that athletes consider the importance of iron as part of their diet. Research notes that while both plant-based and animal-based dietary products have iron, the iron in the former is not readily available as that in the latter [25]. To elaborate, vegan and plant-based diets have iron in non-haem form, while that in animal-based diets is in haem form. In the body metabolic processes, the adoption of haem iron is noted to be faster as compared to non-haem form and to this extent, it is common to find that vegan and plant-based diet individuals, have a deficiency in iron when compared to omnivorous individuals. Researchers are in agreement that in athletics, vegan and

plant-based diet athletes have been noted to have deficiency in iron content [23-25]. This is especially true when comparing athletes undertaking endurance training. Nonetheless, iron is readily available as a supplement which are easily adoptable in the human body, and this provides respite for vegan and plant-based diet athletes. Accordingly, it is advised that vegan and plant-based diet athletes ensure that they have sufficient iron nutrients in their bodies to support their sporting activities.

Proteins are also an important consideration when discussing nutritional effect of different diets. According to evidence of research, different athletes require different types of protein levels depending on the intensity of their exercise and by extension the energy requirements for the same [26]. It has been agreed also that athletes and people involved in sporting activities would generally require more protein intake when compared to those who are not involved in athletics [27]. Further evidence of research brings perspective to the importance of protein in the diet of athletes indicating that protein helps in the provision of energy for exercises and helps in the adaptation of exercises by the body [28]. Proteins are the fuel for performance in sporting activities and goes ahead to note that vegan and plant-based athletes consume less proteins when compared to their non-vegan counterparts. Concurrent evidence of research supporting the foregoing position indicates that common plant-based proteins are deficient in certain amino acids for instance the Branched Chain Amino Acids (BCAA) [29]. Accordingly, amino acids are more prevalent in animal-based proteins and are the requisite elements for more strength and energy during exercise. To this extent therefore, the lack of these acids in the vegan and plant-based proteins implies that the athletes would be deficient of the required amount of energy to partake in the sporting activities. In buttressing the foregoing point, the metabolic activities during exercises indicated that amino acids in animal-based products register higher tendency of supporting muscle recovery and bodily adaptation to exercise [16]. It is noted from the findings of the aforecited evidence that for optimal results, especially in strength training, it is critical to increase the protein intake [16]. There is an agreement among researchers that animal-based products have a stronger protein provision compared to plant-based products – for instance, milk has been found to have stronger protein content that can effectively support endurance, recovery and adaptation of exercise [23-27]. Further, the researchers provide advice regarding reliance on plant-based products as a source of protein. According to the researchers, different cereals have different compositions of amino acids and proteins while lacking in others. Unlike animal-based proteins which has a rich endowment of amino acids, plant-based products have limited endowment. To this end, sufficient protein content can be achieved by properly curating a range of cereals and plant-based products to ensure that the maximum protein intake with the most diverse and complete range of amino acids is achieved and, in this way, it is possible to have sufficient protein content for sporting activities.

Nutritional supplements

To this point, the review of extant literature on vegan and plant-based products and their suitability for sports professionals' performance has shown that while vegan and plant-based diets have their advantages, there are nutritional elements that need to be considered. These nutritional elements, for instance vitamins, and amino acids have been noted not to be presently available in plant-based products. With this understanding in mind, reviewing some of the common supplementary options for vegan and plant-based diet athletes is critical. This is because it will help direct the athletes, coaches and nutritionists towards the right direction of improving their vegan diet readiness for sports performance. Two supplements will be suggested herein as found out from research – beta alanine, and creatine.

Beta alanine is an important element in muscle adaptation, recovery and regeneration. It is mostly a protein and has been found to be mostly lacking in vegan and plant-based products. According to research, the lack of beta alanine can pose challenges to vegan and plant-based diet athletes including but not limited to muscle depletion [30, 16]. When tested in endurance exercises lasting more than a minute, beta alanine was found to lead to better muscle adaptation, reduced fatigue and increased strength. Being that this element is deficient in vegan and plant-based diet athletes, it is suggested that supplementation of this element can be attempted to see the results in terms of strength, endurance, muscle adaptation and recovery.

Creatine is another supplement that research recommends for vegan and plant-based products athletes. Creatine can help improve the muscle stores for vegan and plant-based diet athletes who have been noted to have depleted muscle stores [27]. The research surrounding the applicability of creatine is replete with evidence of how it can help increase and improve the performance of athletes through boosting muscle hypertrophy. This is especially so for athletes who engage in high intensity types of sporting activities which rely on their muscles. Concurrent evidence of research acknowledged that vegan athletes who utilized creatine supplements reported improved performance, reduced oxygen consumption in submaximal activities and improved muscle creatine stores over time [3].

CONCLUSION

The current study in reviewing findings from previous evidence of literature has established that vegan and plant-based diets while ethically sound, tend to be deficient in critical nutrients. These nutrients have been found to include vitamins and proteins and while in some instances it has been shown that vegan and plant-based diets have the necessary nutrients, the quality of the nutrients and their bioavailability has come up short. The debate regarding vegan and plant-based diet and non-vegan data can however not be put to rest because it is less a dietary problem than it is an ethical problem. From a dietary point of view therefore and considering the remit of the current study which was investigating the suitability of vegan and plant-based diets in sports, it can be stated that while vegan and plant-based diets are sufficient, some nutritional support is needed to ensure that consumers of the diet are able to compete from a level playing field nutritionally. The role of energy in sports and the lack of the same in many vegan and plant-based diets has been highlighted and it has been made clear that there is need for proper curation of vegan and plant-based diets to ensure that the threshold energy requirements are met. This has also been the same when considering certain vital vitamins and nutrients that affect endurance, strength and even recovery post training. The suggestions shared for supplementing the different nutrients as well as the supplementary elements highlighted towards the end can be taken up by coaches, athletes and nutritionists to improve their performance. The current study acknowledges that the subject field is rapidly developing and further empirical research in the field will help unravel some of the best ways of ensuring that vegan and plant-based athletes fit and compete in a nutritionally fair playing field without compromising their nutritional beliefs.

Ethical considerations

The methodological approach of the research – being anchored on secondary publicly available data did not bring any ethical contentions. All information adopted from previous works was fully cited and acknowledged.

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Competing Interests
The researcher knows of no conflict of interest that could have in one way or another influenced the conduct and/or outcome of the present study.

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Contributorship

Author	Contribution
Akshita Premashish Shrivastava	Conduct of full research, and writing as well as compilation of the review.

Data Sharing Statement
Not Applicable

Patient Involvement
No

Summary

- There exists conflicting knowledge as to the impact of vegan and plant-based diets on the performance of athletes
- Vegan and plant-based proponents have established that there is negligible difference in performance caused by dietary differences
- Contrary evidence of research suggests that vegan and plant-based diets are deficient in key nutrients that relate to muscle tenacity and performance
- Current review acknowledges that while athletes taking vegan and plant-based diets may not necessarily be outperformed by their counterparts, their endurance is significantly lower.

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