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Analysis of female Olympic runner's performance based on diets

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Abstract

This study presents the impact of omnivorous (OMN) and vegan (VG) diets on female Olympic runners' performance. It seeks to ascertain which diet would yield superior outcomes. Three VG runners and three OMNI runners will be evaluated as part of the study to compare their athletic abilities. This paper proposes that VG female Olympic runners will outperform those following the OMNI diet. This study will be conducted in six steps: (1) the basic insight of how each diet affects a runner's performance, (2) analysis and calculations of VG runner's performance development prior to the appropriate Olympic games, (3) analysis and calculations of OMNI development on each runner with equivalent years before the corresponding Olympic games, (4) comparison between the OMNI and VG runners of the 1-year development, (5) comparison between the OMNI and VG runners of the 3-year development, and (6) comparison between the OMNI and VG runners of the 6-year development. The study reveals a complex relationship between dietary choices (VG and OMN) and runners' performance, with the OMNI group showing superior results in two instances.

Keywords: OMN, VG, Olympic, Performance, Development, Dietary, Athletic

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Introduction

Diet constitutes one of the many significant factors in the manner in which an athlete performs. Many such diets exist, but omnivorous (OMN) and vegan (VG) diets are firmly disputed. Which of these two diets of female Olympic runners will produce superior outcomes? This paper aims to examine existing literature and individual calculations to identify the performance aspects that are impacted. It'll be emphasizing what and how a VG or OMNI diet would have made the best performance. Additionally, this includes an examination of how a runner's capacity could shift over time once one starts veganism and OMNI diet respectively. Each group, VG and OMN, will have three Olympic runners each. Morgan Mitchell, Kaylin Whitney, and Isobel Batt-Doyle are the VG Olympic runners this paper will be analyzing. Allyson Felix, Anneliese Rubie, and Elise Cranny are the OMNI Olympic runners, respectively. The OMNI runners are selected based on similar years of experience as the VG runners prior to an Olympic game with the same distances. Additionally, the runners will be classified into three different groups of short-, intermediate-, and long-term time frames relative to the selected runners for a better comprehension of the performance comparison.

Literature review

Numerous research studies have explored the comparisons between plant-based and omnivorous diets from various perspectives. For example, Hevia-Larrain and their team (2021) conducted a study focused on the impact of dietary protein sources, exclusively for plant-based and mixed diets, on changes in muscle mass and strength of healthy young men who engaged in resistance training.

Another investigation by Katharina Wirnitzer (2016) aimed to determine the prevalence of omnivorous, vegetarian, and vegan participants in running events and to discern potential disparities in running performance among these three subgroups. The NURMI study seeks to address the existing knowledge gap related to the prevalence and running performance of endurance runners adhering to vegetarian and vegan diets. It anticipates that the percentage of vegetarians and vegans among running event participants will be lower compared to their representation in the general population. Additionally, the study intends to validate the accuracy of participants' self-reported dietary preferences (Wirnitzer et al., 2016).

In a separate study, Corinne Ciuris and their colleagues (2019) conducted research with the primary objective of evaluating dietary protein quality using the Digestible Indispensable Amino Acid Score (DIAAS) in both vegetarian and omnivore endurance athletes. The findings revealed that omnivorous athletes had higher DIAAS scores and a greater availability of protein compared to their vegetarian counterparts (Ciuris et al., 2019).

In contrast to these studies, this paper aims to investigate the impact of VG and OMNI diets on the performance of female Olympic runners. It seeks to determine whether the results from examining both diets reveal significant differences that can indicate which diet is more conducive to enhancing athletic performance.

Method Diet Effects

Before delving into our research, it is essential to establish the fundamental ways in which veganism and omnivores may influence a runner's performance. This foundational understanding will serve as a basis for evaluating the potential impact of VG and OMNI diets on the runner's performance.

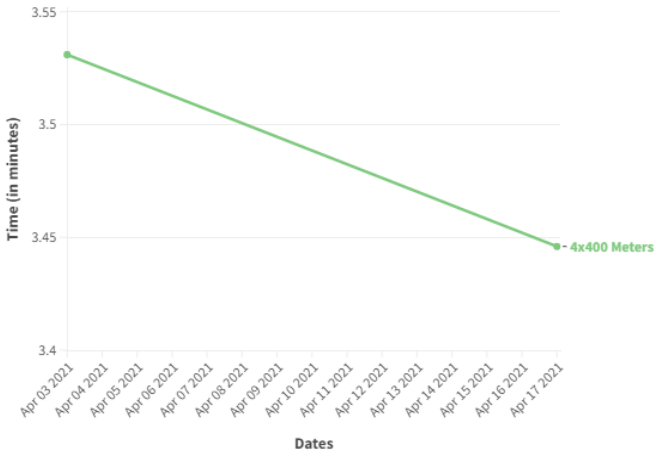
VG diets offer a range of health benefits, such as weight management (Tuso et al., 2013). However, it is important to note potential drawbacks. Additionally, strict adherence to a VG lifestyle has been linked to issues such as hair loss, weakened bones, muscle wasting, skin rashes, hypothyroidism, and anemia ("Research Shows Vegan Diet Leads to Nutritional Deficiencies, Health Problems; Plant-Forward Omnivorous Whole Foods Diet Is Healthier," 2022).

In contrast, OMNI diets provide high-quality protein with superior bioavailability, facilitating efficient absorption and utilization within the body (Sencer, 2016). Omnivorous individuals are also less likely to experience nutritional deficiencies compared to their plant-based counterparts. However, OMNI diets may be associated with higher BMI, elevated total cholesterol, increased levels of LDL cholesterol, elevated glucose levels, and an increased risk of ischemic heart disease and certain types of cancer when compared to plant-based dietary patterns (Swartz, 2018).

VG Development Trend(s)

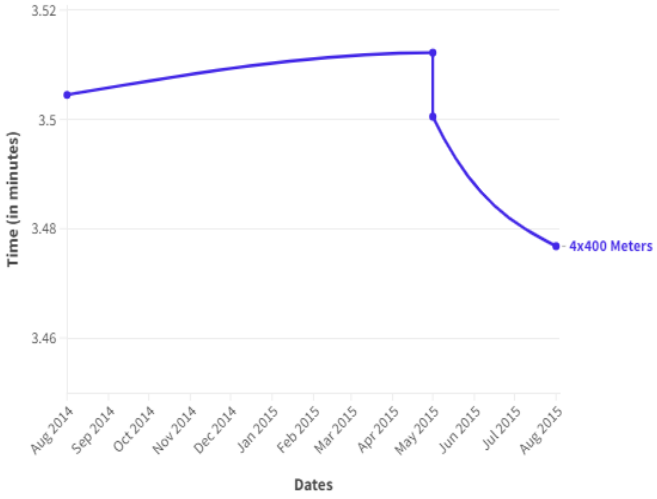
Each Olympic runner has a unique beginning and completion date that corresponds to when they commenced their VG diet and the beginning of the appropriate Olympic game. This piece examines the fluctuation of time among the many tournaments in which they have each participated from their "all-time personal best (PB)." Should the VG diet exert any influence from the outset, the implications would manifest conspicuously in the ensuing graphical representations, denoting a discernible reduction or growth in time. Moreover, these graphs are individually allocated to each specific distance, contingent upon the respective runner's specialization. The existence of a graph for a given distance hinges on the number of running events undertaken at that prescribed distance, necessitating a minimum of two events with a substantiated time differential to warrant inclusion.

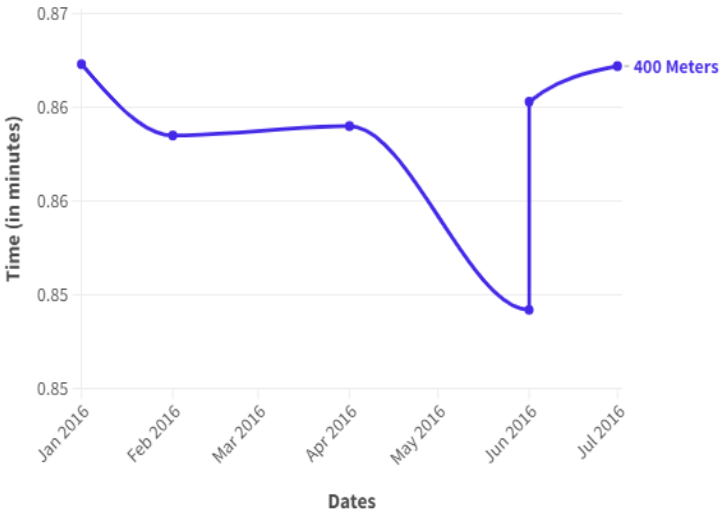
Kaylin Whitney is classified in the "short-term frame," where she began her VG diet in early 2020 (Broadbent, 2023). Calculations will be made with the number of tournaments she participated in from the beginning of 2020 to July 23rd of 2021, the start of the Olympic Games Tokyo 2020; this game was postponed due to the outbreak of COVID-19 (Rich et al., 2020). During this time frame, of Whitney's "all-time PB," she had participated in approximately eleven competitions: one 4x200-relays, two 4x400-relays, six 400-meter races, and two 300-meter races (*Kaylin WHITNEY | Profile | World Athletics*). The graphs below present the trend of Whitney's score, the time in minutes, on the 4x400, 400, and 300-meter races for their specific time frames.

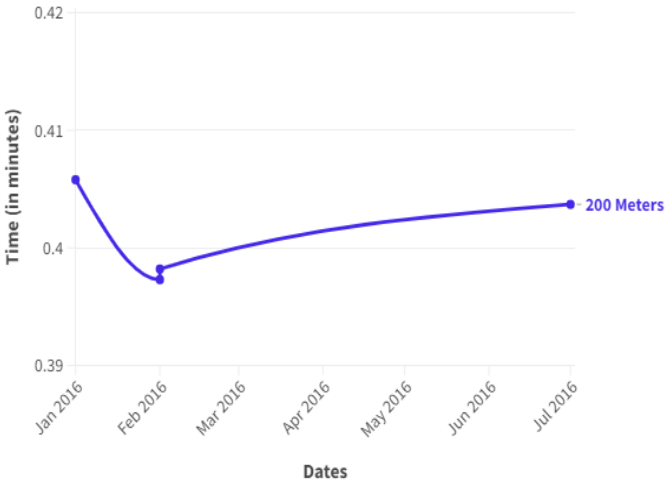


Morgan Mitchell is assigned to the "intermediate frame," where she started adhering to a vegan diet in 2013 ("Morgan Mitchell Interview," 2022). Similar to Whitney, this study will compute the outcomes of the competitions Mitchell competed in between 2013 and August

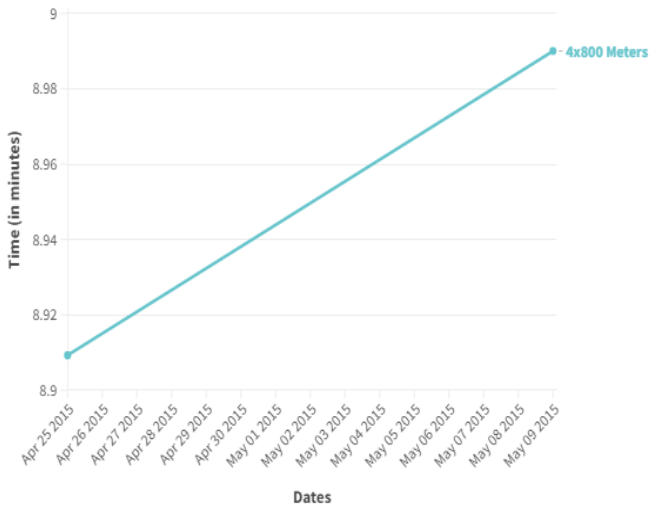
5th, 2016, the beginning of the Olympic Games Rio de Janiero 2016. Mitchell had competed in about fifteen events during this period from her "all-time PB," including four 4x400-relays, six 400-meter races, four 200-meter races, and one 100-meter race (Morgan MITCHELL | Profile | World Athletics) The following graphs depict Mitchell's performance trend in the 4x400, 400, and 200-meter events.

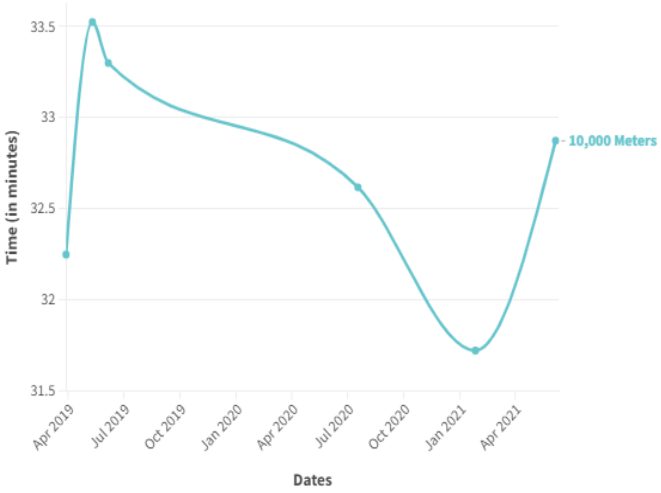


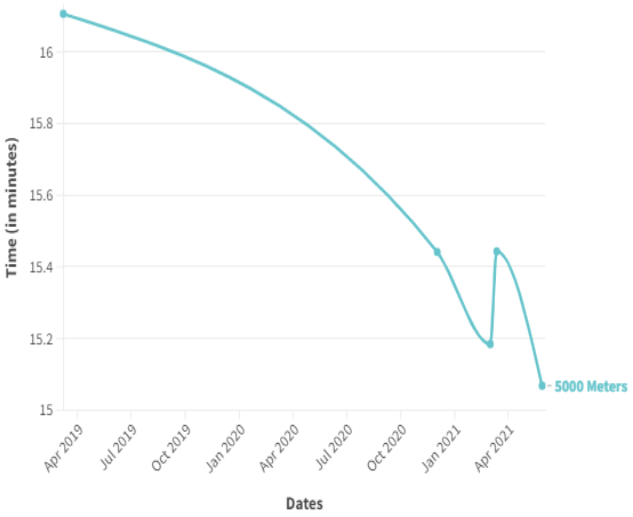


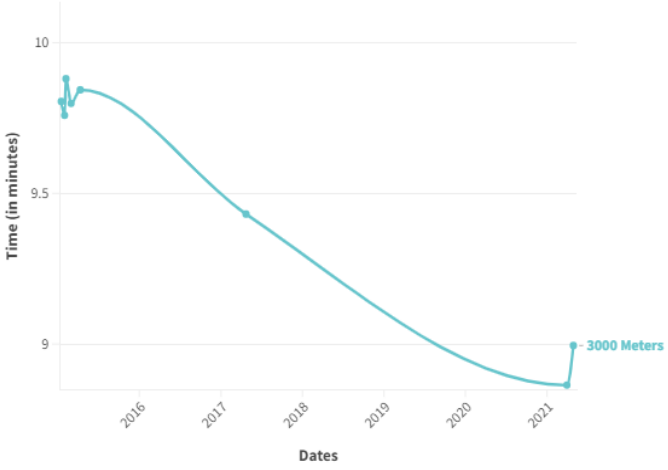


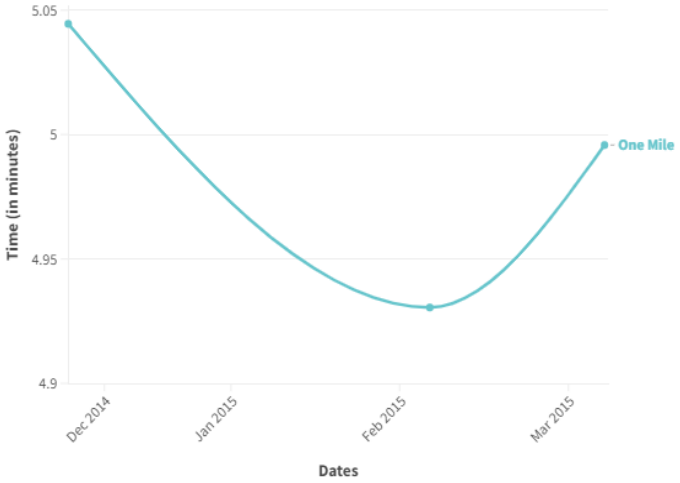
Lastly, Isobel Batt-Doyle is classified into the "long-term frame," where she adopted a vegan lifestyle approximately at the dawn of the year 2015 ("My Interview with Izzi Batt-Doyle, Plant-Based Olympic Runner," 2021). Parallel to the two previous VG Olympic runners, the calculations will be driven by Batt-Doyle's scores obtained from her competitions between November 2014 and July 23rd, 2021, the onset of the Olympic Games Tokyo 2020. Batt-Doyle had taken part in approximately thirty-six events during this period of her "all-time PB," including two 4x800-relays, six 10,000-meter races, five 5000-meter races, nine 3000-meter races, four one-mile races, and ten 1500-meter races (Isobel BATT-DOYLE | Profile | World Athletics). The performance trend for Batt-Doyle in the 4x800 relays, 10,000, 5000, 3000, one-mile, and 1500-meter events is shown below.

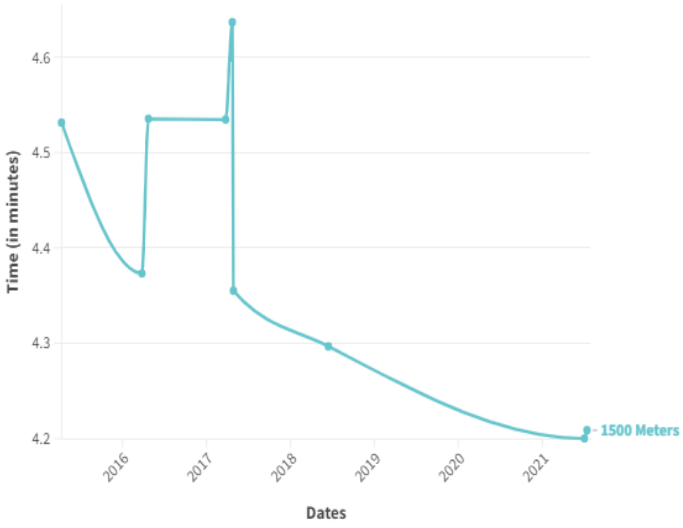



33.5
33
32.5
32
31.5
Time (in minutes)
10,000 Meters
Apr 2019
Jul 2019
Oct 2019
Jan 2020
Apr 2020
Jul 2020
Oct 2020
Jan 2021
Apr 2021
Dates


16
15.8
15.6
15.4
15.2
15
Time (in minutes)
5000 Meters
Apr 2019
Jul 2019
Oct 2019
Jan 2020
Apr 2020
Jul 2020
Oct 2020
Jan 2021
Apr 2021
Dates


10
9.5
9
Time (in minutes)
3000 Meters
2016
2017
2018
2019
2020
2021
Dates



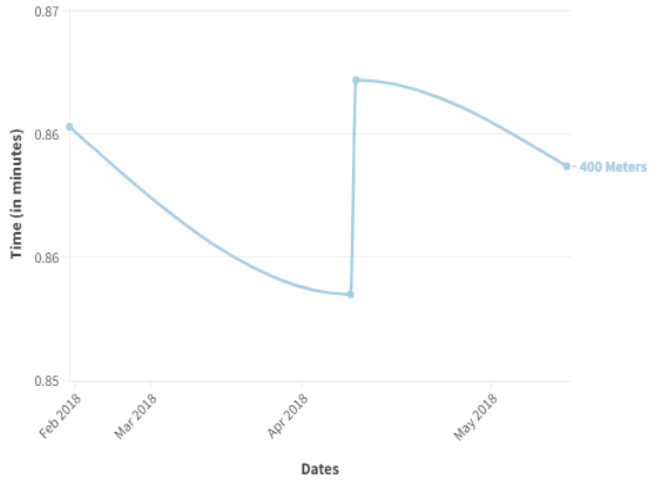


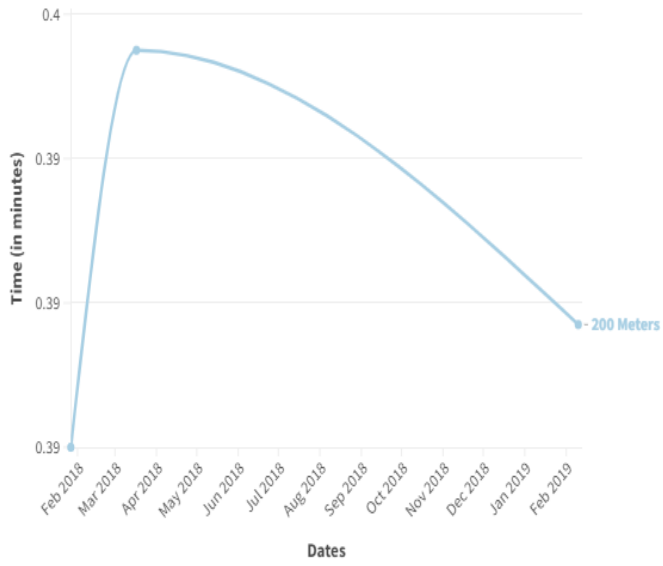
OMNI Development Trend(s)

Like the previous section, this portion of the paper will proceed and calculate the runner's scores with the same process. However, it is important to note that every OMNI runner is systematically matched with a VG runner possessing a commensurate level of training experience, so the data collected from OMNI runners is restricted to a timeframe corresponding to the number of years that their respective VG counterparts had adhered to a vegan lifestyle prior to their designated participation in the Olympic games.

Anneliese Rubie has been paired with the VG runner Whitney, so they're assigned to the "short-term frame." The following calculations will be based on Rubie's performance data over a comparable duration to when Whitney embarked on her vegan journey: spanning from 2020 to July 23rd, 2021. However, it is important to note that due to the limited dataset

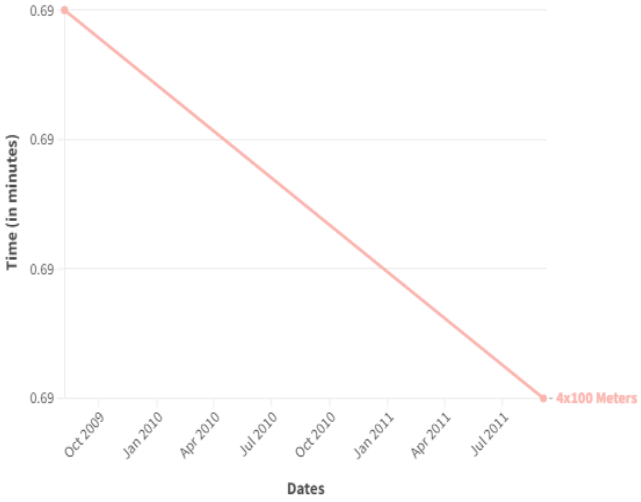
available, significant results weren't attainable. To provide further insight into performance fluctuations, this analysis will also encompass a different timeframe within the same interval, specifically from 2018 to July 23, 2019. Encompassing her "all-time PB," Rubie participated in approximately eight running events including one 4x400-relay, four 400-meter races, and three 200-meter races (Anneliese RUBIE | Profile | World Athletics). Rubie's performance trends in the 400 and 200-meter races are presented below.

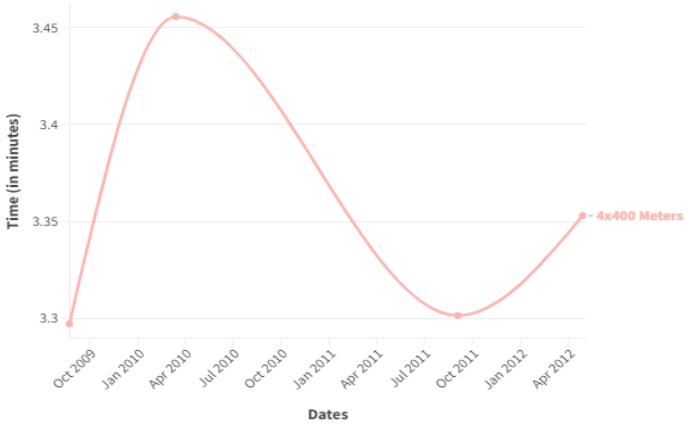


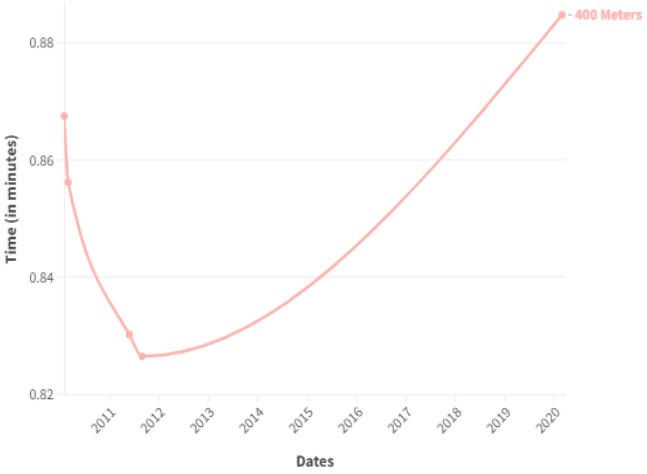


Allyson Felix has been paired with the VG runner Mitchell, so they're assigned to the "intermediate frame." Parallel to the evaluation conducted for Rubie, Felix's performance data will be obtained from 2009 to July 27th, 2012, the beginning of the London 2012 Summer Olympics. Encompassing her "all-time PB," Felix participated in approximately fifteen events, including four 4x400 relays, two 4x100 relays, five 400-meter races, one 200-

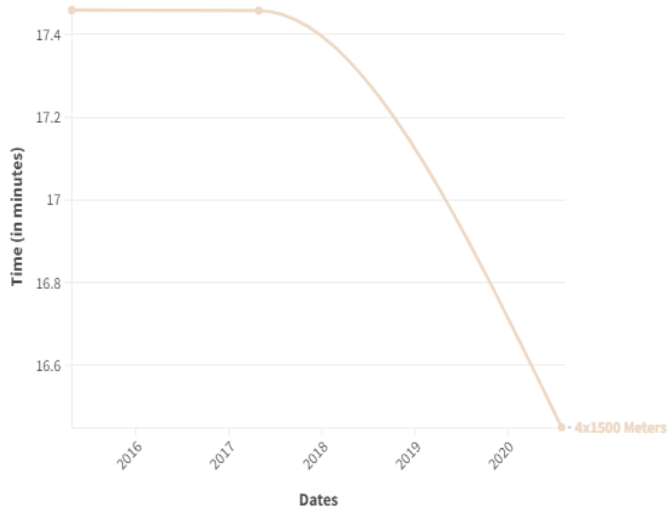
meter race, one 100-meter race, and two 60-meter races (Allyson FELIX | Profile | World Athletics). The ensuing graphs represent Felix's performance trends in the 4x400, 4x100, and 400-meter events.

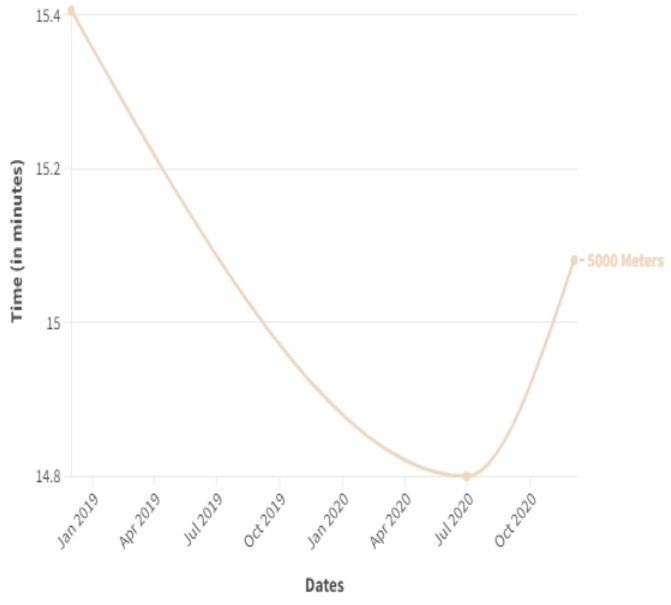


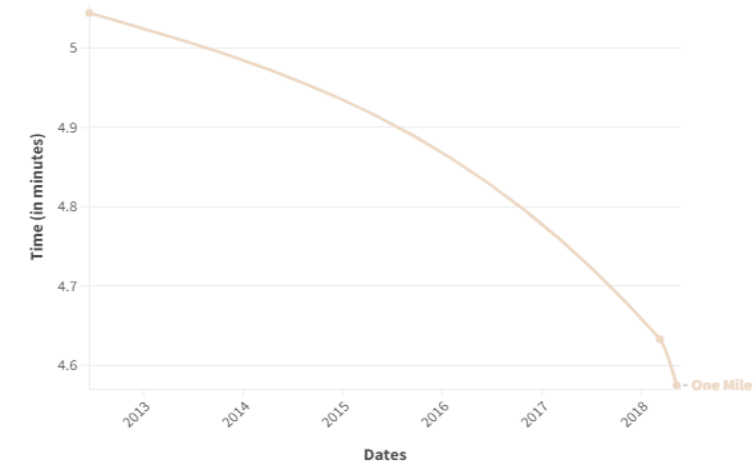


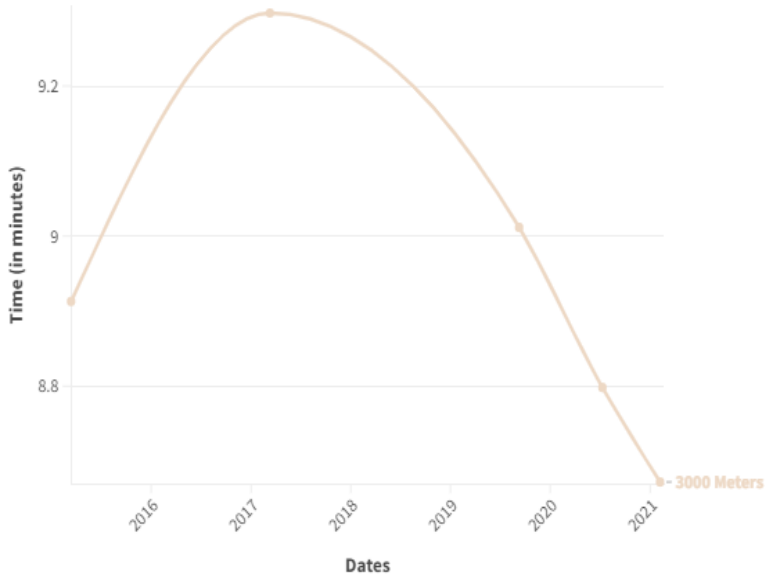


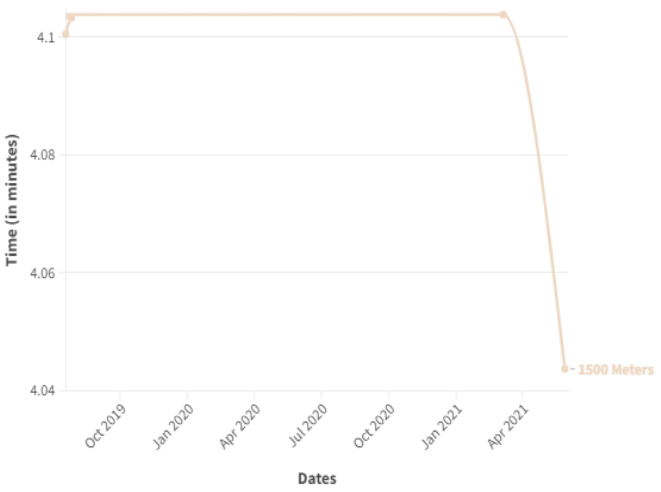
Lastly, Elise Cranny has been paired with the remaining VG runner, Batt-Doyle, and is classified into the "long-term frame." Equivalent to the two previously examined OMNI runners, this section will focus on an assessment of Cranny's performance scores covering the period from 2015 to June 18th, 2021, the start of the US 2021 Olympic Trials. During this timeframe, Cranny, reflecting her "all-time PB," participated in approximately thirty-one events, including three 4x1500-relays, one distance medley relay, one one-mile road race, one 10,000-meter race, three 5000-meter races, five 3000-meter races, three one-mile races, five 1500-meter, seven 800-meter races, and two 600-meter races (Elise CRANNY | Profile | World Athletics). The following graphs illustrate Cranny's performance trends in the 4x1500-meter relays, 5000-meter, 3000-meter, one-mile, 1500-meter, 800-meter, and 600-meter events.

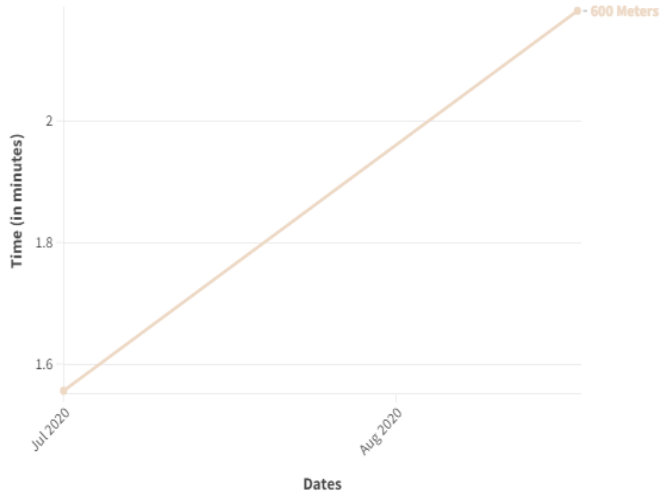


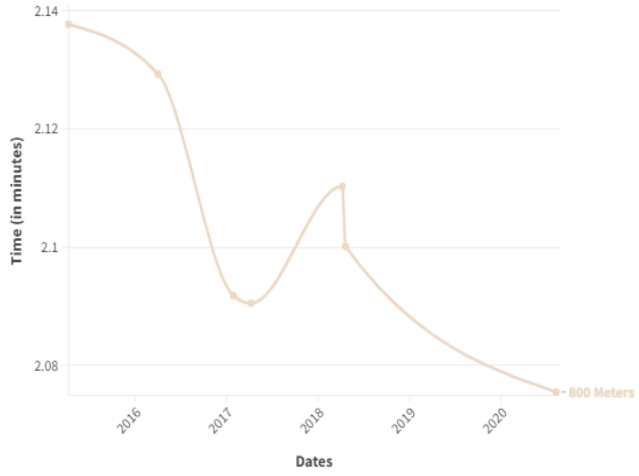



5
4.9
4.8
4.7
4.6
Time (in minutes)
2013
2014
2015
2016
2017
2018
Dates
One Mile


9.2
9
8.8
Time (in minutes)
2016
2017
2018
2019
2020
2021
Dates
3000 Meters


4.1
4.08
4.06
4.04
Time (in minutes)
Oct 2019
Jan 2020
Apr 2020
Jul 2020
Oct 2020
Jan 2021
Apr 2021
Dates
1500 Meters





Short-Term Frame

Utilizing the recorded performance data of both Whitney and Rubie, this analysis aims to comprehensively illustrate the disparities in their respective achievements. Given that Whitney and Rubie have participated in primarily two types of distances, the assessment will primarily focus on their performances in the 4x400-relays and 400-meter races.

In the 4x400-relay events, Whitney participated in two races, achieving times of 3.531 minutes and 3.446 minutes, whereas Rubie participated in a single race with a recorded time of 3.4572 minutes. These results unequivocally demonstrate that when comparing their initial scores, Rubie outperformed Whitney in the 4x400-relay events.

Turning our attention to the 400-meter races, Whitney recorded individual scores ranging from 0.8382 to 0.8548 minutes. On the other hand, Rubie achieved individual scores ranging

from 0.8585 to 0.8672 minutes. These data establish that Whitney delivered a superior performance in the 400-meter events, as her times consistently fell below Rubie's lowest recorded time.

Intermediate Frame

In alignment with the preceding section, this segment focuses primarily on the 4x400-relays, 400-meter, and 200-meter events, as these distances were commonly participated in by both Mitchell and Felix. In the 4x400-relay events, Mitchell achieved data points ranging from 3.4768 to 3.5122 minutes. These results exhibit a pattern of initial regression followed by subsequent improvement in performance. Conversely, Felix attained individual scores ranging from 3.2972 to 3.4557 minutes. This data reflects significant fluctuations and instability in performance. Upon analyzing the data, it becomes evident that Felix achieved superior performance, as all her scores fell below Mitchell's lowest recorded time in the 4x400-relay events.

Turning to the 400-meter events, Mitchell recorded scores ranging from 0.8542 to 0.8673 minutes. These scores suggest a degree of instability and notable performance fluctuations. In contrast, Felix obtained individual scores ranging from 0.8265 to 0.8848 minutes. This data reveals a consistent improvement, albeit with a significant setback toward the end. While three out of five of Felix's scores outperformed Mitchell's, placing them below all of Mitchell's scores, the remaining scores of Felix were inferior to Mitchell's, positioning them above all of Mitchell's scores.

Lastly, in the 200-meter races, Felix participated in a single event with a time of 0.3672 minutes, while Mitchell achieved scores ranging from 0.3973 to 0.4058 minutes. These results demonstrate consistent regression in Mitchell's performance. Although the limited data makes it challenging to make a precise comparison of performance, Felix's time does place below all of Mitchell's scores, suggesting superior performance on her part.

Long-Term Frame

Similar to the previous sections, this portion of this piece will proceed in the same process. In this case, Batt-Doyle and Cranny shared distances of 10,000-meter, 5000-meter, 3000-meter, one-mile, and 1500-meter events. In the context of the 10,000-meter events, Cranny's participation was limited to a single event with a time of 30.7903 minutes. On the other hand, Batt-Doyle's performance derived from a series of times ranging from 31.721 to 33.5217 minutes. Batt-Doyle's performance exhibited inconsistency with an initial spike followed by a consistent improvement, concluding with a setback that surpassed the initial time. Given the limited data available for Cranny, making precise evaluations is challenging. However, the fact that Cranny's time was lower than all of Batt-Doyle's implies her performance is superior in this event.

In the 5000-meter events, Batt-Doyle recorded scores ranging from 15.0683 to 16.1063 minutes, whereas Cranny achieved scores ranging from 14.8003 to 15.4053 minutes. Batt-Doyle displayed overall improvement, despite a temporary regression. Cranny, while showing a minor improvement from the initial time, did not exhibit the same significant progress as

Batt-Doyle. Three out of five of Batt-Doyle's scores surpassed all of Cranny's, with the remaining scores falling either in between or below Cranny's scores. This suggests that while Batt-Doyle demonstrated considerable improvement, Cranny's overall performance was superior, as her scores consistently fell below Batt-Doyle's.

In the 3000-meter races, Batt-Doyle recorded times ranging from 8.8637 to 10.1127 minutes, experiencing intermittent regression but displaying significant overall improvement. Cranny, on the other hand, exhibited minor improvements with a single regression discontinuity with her times ranging between 8.6722 to 9.2975 minutes. Similar to the 5000-meter events, despite Batt-Doyle's significant progress, Cranny consistently achieved the lowest scores, indicating superior performance in this category.

In the one-mile races, Batt-Doyle achieved times of 5.0445 mins, 5.045 mins, 4.9305 mins, and 4.9958 mins, while Cranny achieved times of 5.0442 mins, 4.6328 mins, and 4.5747 mins. In this category, Cranny displayed greater improvement, with two out of three of her scores lower than Batt-Doyle's, and the remaining score falling in line with Batt-Doyle's. This suggests that Cranny not only exhibited pronounced development in performance but also superior performance in the one-mile events.

Finally, in the 1500-meter races, Batt-Doyle's scores ranged between 4.2 to 4.6367 minutes, displaying fluctuating performance over this period. In contrast, Cranny achieved scores ranging from 4.0437 to 4.1038 minutes with all of her scores consistently placing below those of Batt-Doyle's. This unequivocally demonstrates Cranny's superior performance in the 1500-meter races.

Results Primary Outcome

In light of the performance data presented, it is evident that the association between dietary choices (VG and OMN) and the performance of runners is intricate. This study has revealed that among the six Olympic runners examined, although the VG group displayed more pronounced performance improvements, there were two instances that favored the OMNI group in terms of superior performance.

Secondary Outcome(s)

As indicated by the trends observed in the *VG Development Trend(s)*, approximately half the graphical representations exhibit a noteworthy initial decrease in time followed by a subsequent substantial increase. Additionally, five of the trends concluded with a decrease in time compared to the starting point, while only one showed a consistent increase from the initial measurement. These patterns suggest a positive correlation between the VG diet of the runners and their athletic performance, with a notable reduction in time being a potential outcome.

In contrast, the trends observed in the *OMNI Development Trend(s)* displayed the graphical representations of a wide array of patterns over the specified timeframe. The notable variability in performance trends, coupled with the parallel outcomes, implies that the OMNI diet may have comparable effects to the VG diet on the runners' performance.

In the *Short-Term Frame*, while Rubie demonstrated superior performance in the 4x400-relay event, Whitney showcased pronounced performance in the 400-meter races. These findings suggest that there may not be a direct correlation between dietary choices (VG or OMN) and the runner's performance in this timeframe.

According to the *Intermediate Frame,* Felix consistently demonstrated superior performance compared to Mitchell. Therefore it displays that OMNI may have superior effects on the performance.

Based on the *Long-Term Frame,* Cranny consistently outperformed Batt-Doyle across various race distances and displayed superior overall performance in these events, indicating that OMNI may have produced positive impacts on performance.

Limitations

This study has several limitations that should be considered. Firstly, the study has a relatively small participant sample, which may limit the generalizability of the findings. Furthermore, it does not account for inherent variations stemming from factors such as genetics, metabolic differences, diverse training regimens, and other influential elements that can significantly impact the performance of the athletes. Additionally, the research does not comprehensively address potential confounding variables, including variations in training intensity, coaching quality, sleep patterns, and the athletes' injury histories, all of which can independently affect performance, irrespective of their dietary choices. The study primarily focuses on time-based performance metrics, such as race times, possibly overlooking the broader spectrum of athletes' performance attributes, including strength, endurance, agility, and various other variables. Moreover, the selected timeframes for analysis, namely short-term, intermediate, and long-term intervals, may not provide a sufficient duration to fully capture the lasting effects of dietary choices on performance. Therefore, gaining a more comprehensive understanding of this complex relationship may require more extended, long-term investigations. Lastly, the study does not systematically account for external factors, such as changes in training facilities, equipment modifications, or evolving competition conditions, all of which have the potential to influence performance trends over time.

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