Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

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Original research

Vaccine versus infection – COVID-19-related loss of training time in elite athletes

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ABSTRACT

Objectives: To determine the number of training days lost due to COVID-19 and vaccination against COVID-19 in elite athletes.
Design: Retrospective cohort study.
Methods: The questionnaire on the impact of vaccination and COVID-19 on training plans was filled out by 1073 elite Polish athletes who underwent routine medical screening between September and December 2021.
Results: COVID-19 was diagnosed in 421 subjects (39 %), of whom 26 % were asymptomatic. On the 10-point scale, <1 % of athletes had perceived severity of the disease above 8, whereas for 64 % it was 4 or below. Vaccination against COVID-19 was administered in 820 athletes (76 %), and adverse events were observed more frequently after the first dose than the second (69 % vs. 47 %).
Influence on training (modified or lost) was declared by 369 of 421 (88 %) COVID-19 athletes, and by 226 of 820 vaccinated athletes (28 %). During the observation period, the average number of lost training days was 8.1 for COVID-19 and 2.6 for vaccination ($p < 0.001$). The cumulative number of person-days lost due to COVID-19 was 1041 versus 295 after vaccination thus, the average loss ratio was $1041/1073 = 0.97$ vs. $295/820 = 0.36$, respectively, $p < 0.01$.
Conclusions: Athletes have a considerable loss of training days due to COVID-19. Vaccination against COVID-19 causes significantly smaller and predictable loss. This supports the inclusion of vaccination into prevention policies for athletes whenever they are available.

Practical implications

- Absence in sport resulting from COVID-19 is unpredictable in time and considerably higher than after other respiratory diseases.
- Vaccination against COVID-19 causes significantly smaller loss, moreover, the date of vaccination can be planned at a convenient time or even off-season, additionally limiting the loss.
- The prevention policy for athletes should include vaccination whenever available, as the benefit–loss ratio strongly favors vaccination.

1. Introduction

The new SARS-CoV-2, probably bat-borne, has been introduced to the human population and has completely changed the approach to infectious diseases, also from the perspective of sports medicine. Unfortunately, it is likely that climate change will increase the probability of such new, zoonotic infections in the future.[1] Therefore, the medical community should take a lesson from the COVID-19 pandemic.

Despite some disturbing reports at the beginning of the pandemic, the SARS-CoV-2 infection in athletes results typically in a mild, self-limiting illness.[2–4] The disease is associated with a low prevalence of cardiac involvement.[5–7] However, approx. 8 % of athletes may suffer from persistent symptoms which impair their ability to exercise.[7] Even a brief break due to infection can affect athletic performance,

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cause withdrawal from competition, and bring a financial loss for professional athletes.[8]

Therefore, the main challenge for sports clinicians is to create an effective strategy to protect the athletes' health while simultaneously minimizing the number of lost training sessions.

With a massive effort from the scientific community, the SARS-CoV-2 is one of the best-known viruses today, effective vaccines have been discovered, and more than half of the world's population has been vaccinated within one year. Although vaccination is widely accepted within the sports community, some people are reluctant to vaccination, including athletes and coaches.[9] The main drivers of vaccine hesitancy are possible side effects that could result in missed training and decreased performance.[10]

The aim of the study was to evaluate the number of training days lost by elite athletes due to the adverse effects of COVID-19 vaccination and to compare that number with the number of training days lost due to COVID-19.

2. Methods

The study was conducted on 1073 elite Polish athletes representing different sports who underwent routine medical screening between September and December 2021 (Table 1).

Participation in the study was voluntary. Given the size of this sample and the number of athletes of the complete Polish National Team (n = 7536), the maximum error was 3 % for the confidence level of 95 % and the fraction size of 0.5. The data collection was arranged to ensure the anonymity of the respondents and confidentiality. Each subject signed the written informed consent. The study protocol was approved by the Ethics Committee (permission number AKBE/180/2021).

The questionnaire consisted of 28 questions on demographic data, having undergone COVID-19, perceived course of the disease, impact on training plans, and COVID-19 vaccination and its impact on training. The questionnaire was validated in a pilot study involving 30 randomly selected athletes.

Athletes were classified as having COVID-19 when they had a positive result in either PCR or antigen test or had COVID-19-like symptoms with an epidemiological link.

Training modification was defined as any change to the previously scheduled training plan (reduced duration, inability to perform a single task, and similar, including lost training) due to COVID-19 symptoms or vaccination side effects. In contrast, lost training was the inability to train (missing the training session completely). The athletes who were mandatory quarantined due to contact or with confirmed infection who were obligatory isolated but were asymptomatic and declared that they could train were not included in the calculation of lost training days.

The COVID-19 vaccination was voluntary for elite athletes. The available vaccines were two-dose BNT162b2 (Comirnaty, Pfizer), two-dose mRNA-1273 (Spikevax, Moderna), two-dose ChAdOx1-S (Vaxzevria, AstraZeneca), and one-dose Ad26.COV2.S (Janssen/Johnson&Johnson).

The analysis was performed using the R software (version 4.1.2). The data are presented as mean ± SD; the significance level for all tests was set at 0.05. The following tests were used: Wilcoxon signed rank test (impact of vaccination and the effect of gender and age on the perceived severity of COVID-19); correlation test (effect of perceived severity of COVID-19 on training, relationship between severity and age); chi-square tests (relationship between severity and gender or sports category or discipline, influence of the type of vaccine on the frequency of adverse events); Pearson's chi-squared test (proportions - relative differences in lost training days between vaccination and COVID-19).

The comparison between various vaccine types was only performed for BNT162b2 and Ad26.COV2.S, as the number of athletes vaccinated with mRNA-1273 and ChAdOx1-S was too small.

The cumulative numbers of person-days lost due to COVID-19 and side effects of vaccination were calculated as the number of persons affected multiplied by the number of lost training days. The average loss ratios were found by dividing the cumulative numbers of person-days lost due to COVID-19 and the side effects of vaccination by the number of athletes in the entire and vaccinated groups, respectively. To track the changes in the proportion of athletes unable to train due to COVID-19 or vaccination over the following days after the disease symptom start or after the vaccine shot, we studied the curves representing the courses of changes of these proportions against the number of days lost. We introduced a static threshold line at 5 % of the proportion to evaluate differences in the course of changes. The earlier crossing of that line indicates a better outcome.

We calculated the odds of losing at least one training day due to COVID-19 or vaccination. It was calculated as a ratio of the proportion of athletes who lost training to the proportion of athletes who did not lose training (the proportion of athletes who lost training / 100% – the proportion of athletes who lost training). To assess how the odds change day by day, we also calculated the odds of losing training separately for each consecutive day following the onset of the disease or after vaccination.

3. Results

Among all 1073 examined athletes, COVID-19 was diagnosed in 421 subjects (39.2 %, 187 females and 234 males). The clinical diagnosis was laboratory-confirmed in 286 athletes, and in 135 athletes, the diagnosis was based on symptoms and epidemiological links. At least one isolation period or quarantine after contact with an infected person was experienced by 449 (42 %) athletes since the onset of the pandemic. Within the examined group, 820 (76.4 %) athletes were vaccinated against COVID-19 (357 females and 463 males). The BNT162b2 vaccine was used by 431 athletes (52 %), Ad26.COV2.S by 334 (41 %), ChAdOx1-S by 32 (4 %) and mRNA-1273 by 23 (3 %). Participants of the Tokyo

Table 1
Characteristics of the subjects. Mean ± SD.

Sport category	Gender	n	Age [years]	Height [cm]	Body mass [kg]	BMI [kg/m^2]
Strength (32 %)	Female	131	22.0 ± 4.5	168.6 ± 8.1	64.9 ± 17.1	22.7 ± 4.9
	Male	215	22.4 ± 5.2	181.7 ± 8.5	84.7 ± 16.3	25.6 ± 4.0
Endurance (23 %)	Female	119	22.0 ± 5.3	168.6 ± 6.7	59.0 ± 9.6	20.7 ± 2.7
	Male	125	22.8 ± 5.9	183.6 ± 7.1	74.7 ± 10.3	22.0 ± 1.9
Mixed (34 %)	Female	144	20.7 ± 6.5	174.1 ± 9.0	68.3 ± 12.1	22.5 ± 3.0
	Male	223	20.4 ± 7.0	187.2 ± 9.1	82.4 ± 12.6	23.4 ± 2.6
Technical (11 %)	Female	48	24.9 ± 7.3	169.1 ± 9.9	61.8 ± 10.6	21.5 ± 2.6
	Male	68	26.3 ± 11.0	178.1 ± 6.9	71.0 ± 14.6	22.3 ± 4.1
Total		1073	22.1 ± 5.6	178.3 ± 10.9	73.7 ± 16.3	23.0 ± 3.7

Sports categories: strength (alpine skiing, athletics (sprinters, throwers, and jumpers), bobsleigh, canoeing, judo, skeleton, speed skating sprint, sport climbing, taekwondo, track cycling, weightlifting, wrestling), endurance (athletics (distance running, racewalking), biathlon, cross-country skiing, modern pentathlon, mountain biking, nordic combined, road cycling, rowing, speed skating (1000–5000 m), swimming), mixed (badminton, basketball, volleyball, boxing, figure skating, football, handball, sailing, table tennis, tennis), and technical (archery, artistic gymnastics, curling, golf, high diving, skateboarding, ski jumping, snowboard, shooting, fencing, wushu).

Olympic Games (23 Jul–8 Aug 2021) were mostly vaccinated with Ad26.COV2.S (78 out of 104 athletes, 75 %), whereas others using BNT162b2 (412 out of 716, 58 %).

Of the 421 athletes with COVID-19, 348 (74 %) had a symptomatic disease. On the 10-point scale, <1 % of athletes had perceived the severity of COVID-19 above 8, whereas for 64 % it was 4 or below (Fig. 1).

The perceived severity of COVID-19 was significantly lower in athletes who did not decide to get vaccinated (3.4 ± 1.8 vs. 4.0 ± 2.1 in those vaccinated). Female athletes perceived the COVID-19 symptoms as significantly more severe than males (4.2 ± 2.0 vs. 3.7 ± 2.0, $p < 0.01$). There were no correlations between the perceived severity of COVID-19 and age, as well as no relationship between the perceived severity and sports category, or discipline.

Adverse vaccination events were observed more frequently after the first dose than the second, 69 % vs. 47 %, respectively (of 820 vaccinated athletes, $p < 0.001$). After the first dose, the most frequent adverse events were: general malaise 41 %, muscle pain 40 %, headache 34 %, and shivering 27 %; Whereas after the second dose: muscle pain 25 %, general malaise 24 %, headache 17 %, and pain at the injection site 15 %. The incidence of adverse events was influenced by the type of vaccine ($p < 0.001$): 91 % after mRNA-1273, 88 % ChAdOx1-S, 80 % Ad26.COV2.S, and 65 % BNT162b2. The frequency of adverse events was not influenced by age and was more frequent in females (79 % vs. 67 % in males, $p < 0.001$). No vaccination-related cardiovascular complications occurred in athletes (myocarditis or pericarditis).

An influence on training (modified or lost) was declared by 369 of 421 (87.6 %) athletes with COVID-19. In 130 individuals of 421 (30.9 %), this was a total inability to train for at least one day (lost training). The perceived severity of COVID-19 positively correlated with the influence on the athletes' training ($p < 0.001$).

Influence on training was declared by 226 of 820 vaccinated athletes (27.6 %). In 156 of 820 cases, this was a total inability to train (19.0 %).

Lost training days were observed in 39 of 431 (9.0 %) individuals vaccinated with the first dose of the BNT162b2 vaccine, in 45 of 431 (10.4 %) vaccinated with the second dose of the BNT162b2 vaccine, and in 88 of 334 (26.3 %) after Ad26.COV2.S.

The rates of modified or lost training due to COVID-19 within the 1073 studied athletes were 34.3 % and 12.0 %, respectively. During the observation period, the average number of lost training days was 8.05 (6 as the median) for COVID-19 and 2.58 (2 as the median) for vaccination ($p < 0.001$).

The proportion of athletes who had lost training days due to COVID-19 and vaccination is presented in Fig. 2.

The cumulative number of person-days lost due to COVID-19 (the number of the affected persons multiplied by the number of lost training days) was 1041, and after vaccination (first dose of all vaccines) 295 (average loss ratio for comparison 1041/1073 = 0.97 vs. 295/820 = 0.36, $p < 0.001$). The cumulative number of person-days lost due to COVID-19 after the Ad26.COV2.S vaccine was 192, whereas for both doses of the BNT162b2 vaccine 180 days (average loss ratio for comparison 192/334 = 0.57 vs. 180/431 = 0.42, $p < 0.001$). When tracking the daily changes in the proportion of athletes unable to train due to COVID-19 or vaccination, the proportion of athletes who lost training days after the first dose of vaccine, when no distinction is made between the vaccines, was higher than after COVID-19 only until day 1.9 (the intercept of the curves), and after that, this relationship reversed. Interestingly, it is caused mainly by the Ad26.COV2.S vaccine, for which this phenomenon is observed until day 2.9, while for both doses of BNT162b2 alone, lost training days are consistently lower than after COVID-19 (Fig. 2).

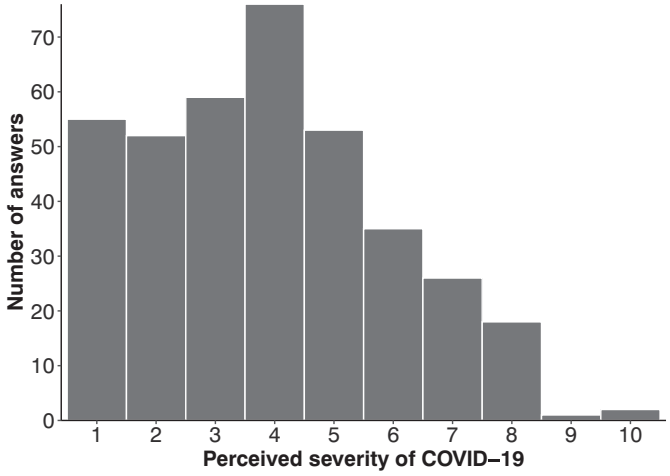

Fig. 1. Histogram of the perceived severity of COVID-19 in athletes.

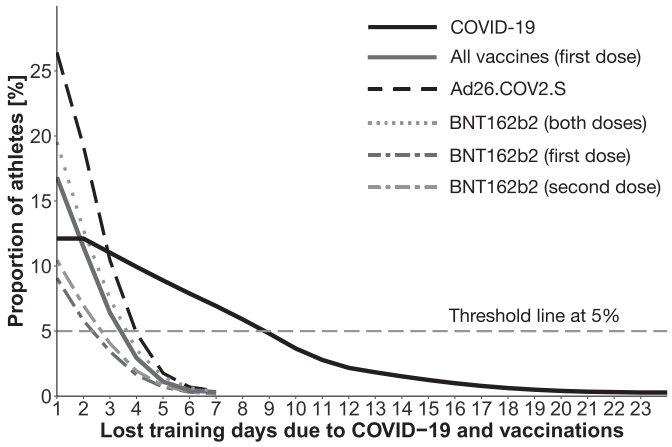

Fig. 2. The comparison of the proportions of athletes who lost training days due to COVID-19 or vaccination. The curves present the percentage of athletes who lost a specific number of training days.

During the observation period, the average number of lost training days was 2.18 for Ad26.COV2.S and 2.13 and 2.16 for the first and the second dose of BNT162b2, respectively (3,27 for both doses of BNT162b2).

The points of intersection of the 5 % static threshold line were 8.8 days for COVID-19 and 3.4 days for the first dose of vaccination (4.0 for Ad26.COV2.S; 2.3 for the first dose of BNT162b2); for the second dose of BNT162b2, it was 2.7 days. The odds of losing at least one training day are 0.14 for the disease and 0.20 for the first vaccination dose. However, since day 3.2, the odds of losing training are higher for COVID-19.

4. Discussion

Since the onset of pandemic, within the examined population of elite Polish athletes, 40 % were affected by SARS-CoV-2. In the US, approximately 19 % of the population with COVID-19 was adults aged 16–29. In the whole EU population, in the age group 16–24, 14 % had a confirmed COVID-19 until December 2021, whereas in Poland, this was only 6 %.[11,12]

The higher rate of infected athletes might be attributed to frequent traveling and gathering in training and competition facilities. However, due to travel and competition regulations, athletes were tested more often, which seems to be the primary explanation for the higher rate of diagnosed infections. In the present study, 26 % of athletes were asymptomatic, and the perceived severity of the symptomatic disease on a 10-point scale was up to 8 in 99 % of athletes and higher in females. In the other studies on athletes, the asymptomatic COVID-19 was found in 58 % (Jun–Sep 2020),[13] 34 % (Mar 2020–Mar 2021),[14] and 16 % among 111 elite Polish athletes (2019–Oct 2020).[4] In the recent review (2019–Jan 2022), including 43 studies and 11,518 athletes, 25.5 % were

asymptomatic.[7] The aforementioned data supports the statement that COVID-19 results usually in a mild, self-limiting illness in the athletic population. Nevertheless, in addition to symptoms and complications, a key indicator of the severity of the disease for sports physicians is simply the number of missed trainings.

There is limited data on the number of lost training days due to COVID-19 in athletes. In the study conducted on 147 elite UK athletes with confirmed or probable COVID-19, the median time loss was 18 (12–30) days, with 27 % not fully available >28 days from the initial date of infection, which was significantly more than for non-COVID respiratory illnesses reasons (6 (0–7) days and 4 % unavailable after 28 days).[15] In 84 athletes with an acute respiratory infection, among whom 45 had confirmed COVID-19, the number of lost training days was three times higher in the COVID-19 group (30 days vs. 10 days in the non-COVID group).[16]

The number of training days lost may depend not only on symptoms but also on COVID-19 management policies and recommendations on return to play after infection. These policies are subject to change during the pandemic and the emergence of other virus variants. The studies cited above do not provide accurate information on how these issues influenced their results.

In the present study, the average number of lost training days due to COVID-19 was 8 days (6 as the median), which is lower than in the data above. However, in this study, only the clinical symptoms were considered; other factors, such as isolation, quarantine, or limited access to sports facilities, were ignored. The criteria for long COVID were met in 4 % of athletes in the present study and 27 % in the UK study.[3,17] In a recent meta-analysis, persistent symptoms of COVID-19 were found in 8.3 % of subjects, who can even lose a whole season.[7]

Non-COVID-19 respiratory tract infections in athletes are better explored, and they constitute 30–75 % of their health problems, nevertheless the data on the number of lost training days is not routinely presented.[18]

The recent review, which included 54 articles (31,065 athletes, 10,706 monitoring days), concludes that the percentage of lost training days due to acute respiratory illnesses is low – 80 % of athletes keep training usually.[19] Interestingly, only a few papers give the exact number of lost training days with the following ranges: 1.7 ± 2.3 and 3.5 ± 5.0 days for upper respiratory tract infections,[20,21] 2.5 days for lower respiratory tract infections,[22] 3.4 training days in the case of 1–2 infections per year,[23] and 1.6 and 4.4 days due to one infection.[24]

Summarizing the discussed data, it seems that athletes suffer overproportionately after infection with SARS-CoV-2, and the "sports cost" of COVID-19 is relatively high compared to the other respiratory tract infections.

The main reason athletes cannot train seems to be fatigue, one of the most reported manifestations of COVID-19.[17] Since fatigue is also a major manifestation of long COVID, it might probably be even better related to long-term loss of training days.

At the end of the present study, 76 % of athletes were immunized against COVID-19, meanwhile the overall percentage of vaccinated people in Poland was 54 %, and in the 18–24 age group, it was 51 %. In the EU it was 66 % and 67 %, respectively.[12]

We did not find data on the proportion of athletes vaccinated in other countries. Sport-specific circumstances likely boost the vaccination rate in elite athletes. To compete, athletes must comply with safety rules set by sports event organizers, and vaccination requirement is an integral part of these rules.

Within the study population, most athletes were vaccinated with BNT162b2, but the second most used vaccine was Ad26.COV2.S. Athletes asked about the severity and frequency of side effects when deciding to vaccinate, but the dosing schedule was also important. The high proportion of athletes vaccinated with Ad26.COV2.S in the present study resulted from its single-dosing during that pandemic period, what was more comfortable just before the Olympic Games.

In the present study, the safety and reactogenicity of COVID-19 immunization in athletes were similar to what was previously reported in the general population.[25,26] The adverse events were primarily systemic and occurred more frequently after the first dose. This can be explained by the fact that subjects were immunized with different vaccines, often, as mentioned above, with a single-dose Ad26.COV2.S vaccine producing pain at the injection site as the most common local reaction (48.6 % of the participants) and headache (38.9 %), fatigue (38.2 %), myalgia (33.2 %) as the most common systemic reactions[26] and also with the ChAdOx1-S vaccine causing systemic side effects most frequently after the first dose.[25]

In the only available study on the athletes immunized with the BNT162b2 vaccine (127 participants), adverse effects were more commonly reported after the second dose than the first.[15] However, the most prevalent adverse reaction was pain at the injection site (94 %). In contrast, systemic reactions were reported by 70 % of participants, with general fatigue being the most prevalent (28 % after the first dose and 37 % after the second dose). A meta-analysis with 73,633 subjects immunized with different COVID-19 vaccines found no significant differences in local and systemic adverse events between the first and second doses.[27]

The incidence of adverse events in the present study was higher in females (79 % vs. 67 % in males), in line with the general population where adverse reactions appear to be more frequent and severe in women, who are also more likely to develop allergic reactions than men.[28]

Dosing and schedule of vaccination change with the course of the pandemic. Therefore, the calculation of vaccination risks (training loss) should be based on the ones associated with a single dose and not on possible speculation on cumulative risks of potential future vaccinations with consecutive doses.[29]

In the present study, influence on training was declared by 27.6 % of vaccinated athletes, and 19 % were unable to train for at least one day. There is little data on the impact on training of any vaccinations in athletes. In the study by Hull et al., 73 % of athletes vaccinated with BNT162b2 reported zero or only minor effects on their ability to train, and 6 % felt completely unable to train but mostly returned to training after one day.[15] The higher number of lost training days in the present study can be explained by the different types of vaccines used and primarily attributed to the side effects of Ad26.COV2.S. The incidence of adverse events in examined athletes was significantly higher after Ad26.COV2.S than after BNT162b2. An interesting comparison can be made with vaccination against influenza. In 234 elite Polish athletes, 2.2 % lost training days, and 5.9 % had to modify training plans within six days of the vaccination.[30] In the study performed in 45 German national and regional level athletes there was no loss training time after influenza vaccination in any athlete.[31] For influenza vaccination, no constraints need to be applied for the timing of vaccinations in relation to athletes' training sessions, but COVID-19 vaccines use different, newer technology: mRNA and viral vectors which explain their stronger reactogenicity.

Therefore, the "sports cost" of vaccination against COVID-19 is higher than that against influenza.

Our study has several limitations. All the data on SARS-CoV-2 infection are limited to Delta or earlier virus variants. This is because the survey covers the period from the start of the pandemic till December 2021.

We recognize that the balance between the vaccine's protective effect and the consequences of the disease may change with Omicron and later variants. The possibility of getting infected is higher now, even for the vaccinated subjects. Yet, the course of the disease seems milder, and the consequences of vaccination remain the same.[32]

The groups of athletes who took different vaccines were unequal and therefore incomparable, and generally imprecise division into a control and intervention group might open room for discussion and criticism. However, although there is no possibility of performing an ideal prospective study with a control group consisting of unvaccinated athletes and an intervention group of the vaccinated, it was a benchmark for our

project. Since our research covers the period from the onset of the pandemic, all the athletes included in the study were for a long time unvaccinated and might be considered the control group. Many of them were later vaccinated and formed an intervention group of vaccinated athletes. This delay with the intervention allowed a comparison to be made.

Another potential limitation of the study is the representativeness of the sample. Due to the applied methodology, the sample might be considered not representative. However, one in seven athletes from the Polish National Team took part in the survey.

5. Conclusions

Athletes have a considerable loss of training days due to COVID-19 that is unpredictable. Even asymptomatic ones with confirmed infection with SARS-CoV-2 may require isolation because of safety precautions resulting in limited training participation. Vaccination against COVID-19 causes a significantly smaller and much more predictable loss of training days than the disease. The only factors that may cause training loss are adverse symptoms and safety precautions due to advice from the physician. The date of vaccination can be planned at a convenient time or even off-season, additionally limiting the loss.

Therefore, the current prevention policy for athletes should include vaccination whenever available, as the loss–benefit ratio is definitely in its favor.

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This research did not receive any specific funding.

Confirmation of ethical compliance

The authors declare that the Bioethics Committee at the Medical University of Warsaw on October 4, 2021, received information about the subject of the study entitled “Assessment of young athletes' attitudes towards vaccinations against COVID-19 and their impact on the implementation of the training program.” The above-mentioned study is consistent with the principles of ethics of scientific research.

Declaration of interest statement

All authors disclose any financial and personal relationships with other people or organizations that could inappropriately influence the present work.

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Appendix A

ATTITUDES OF ATHLETES TOWARDS COVID-19 VACCINATION

Dear Sir/Madam,
The following survey is a key step in the research process conducted by COMS, WUM and UW to learn about athletes' attitudes toward vaccination. The survey is confidential - the data will be analyzed collectively, in order that respondents cannot be identified. Unless otherwise stated next to the question, please mark only one answer of your choice. Thank you for taking part in the survey.

Date the survey was completed: day ☐☐ month ☐☐ year 2021

Gender
☐ woman
☐ man

a. Age ☐☐ years
b. Growth ☐☐☐ cm
c. Body **weight** ☐☐☐ kg
d. Discipline .....
e. Competition ....

Status
a.☐ Tokyo 2020 Olympian/Olympian
b.☐ Paralympian/Paralympic athlete Tokyo 2020
c.☐ International class ME and World Championships
d.☐ national class

Do you live in:

a.☐ alone/alone

b.☐ With other people, but without seniors (people over 65) and/or people with chronic diseases (e.g., diabetes) and/or undergoing cancer treatment

c.☐ With others that include seniors (people over 65) and/or people with chronic diseases (e.g., diabetes) and/or undergoing cancer treatment

Have you ever been in quarantine/isolation since the beginning of the pandemic?

a.☐ yes

b.☐ not

Have you undergone COVID-19?

a.☐ yes, the infection was confirmed by a test and I had/have had symptoms of the disease including a hospital stay

b.☐ yes, the infection was confirmed by a test and I had/have had symptoms of the disease without a hospital stay

c.☐ yes, I had/have had symptoms of the disease, but they were not confirmed by a test

d.☐ yes, the infection was confirmed by a test, but I had/have no symptoms of the disease

e.☐ no *(please go to question 10.)*

f. ☐ don't know *(please skip to question 10.)*

If you marked a., b. or c. in question 6. , how would you rate the course of the disease in yourself? (on a scale of 1 to 10, where 1 means "very mild" and 10 means "very severe")

1 2 3 4 5 6 7 8 9 10

If you marked a., b. or c. in question 6. , what impact did the illness have on disrupting your training plan?

a.☐ Significant

b.☐ rather significant

c.☐ Rather insignificant *(please skip to question 10.)*

d.☐ Insignificant *(please go to question 10.)*

If you marked a. or b. in question 8. , please specify for each day in the table below the degree of training restriction according to the scale, where:

1 means "slight reduction in training"

2 means "a reduction in training that requires a significant change in the training plan"

3 means "no possibility of training

NOTE: please do not include restrictions on training due to sanitary regulations (e.g. quarantine)

Days since the onset of illness	**Day 1-3**	**Day 4-6**	**Day 7-9**	**Day 10-12**	**Day 13-15**	**Day 16-18**	**Day 19-21**	**Day 22-24**	**Day >24**
Training	1 ☐	1 ☐	1 ☐	1 ☐	1 ☐	1 ☐	1 ☐	1 ☐	1 ☐
	2 ☐	2 ☐	2 ☐	2 ☐	2 ☐	2 ☐	2 ☐	2 ☐	2 ☐
	3 ☐	3 ☐	3 ☐	3 ☐	3 ☐	3 ☐	3 ☐	3 ☐	3 ☐

Have you been vaccinated against COVID-19?

a.☐ yes

b.☐ no *(please go to question 14.)*

NOTE: questions 11., 12., 13. are only for those vaccinated against COVID-19

If you marked "yes" in question 10, which vaccine?

a.☐ Pfizer-BioNTech (2 doses).

b.☐ Pfizer-BioNTech (1 dose).

c.☐ Moderna (2 doses)

d.☐ Moderna (1 dose)

e.☐ Astra-Zeneca (2 doses).

f. ☐ Astra-Zeneca (1 dose)

g.☐ Johnson & Johnson

If you marked "yes" in question 10, were you convinced/convinced about vaccination from the beginning?

a.☐ yes, definitely

b.☐ rather yes

c.☐ At first, no, but later I changed/changed my mind

If you marked "yes" in question 10, did you get vaccinated because:

a. I was convinced by my doctor ☐ yes ☐ not

b. I felt/feel pressure from other vaccinated people in the cadre/team/training group ☐ yes ☐ no

c. I felt/feel pressure from the trainer ☐ yes ☐ no

d. I felt/feel pressure from the **union** authorities ☐ yes ☐ no

e. I was afraid that if I got sick or tested positive for COVID-19, I would not perform at the competition ☐ yes ☐ no

f. ☐ Other than the above *(please specify which)*.....

NOTE: questions: 14. and 15. are only for those not vaccinated against COVID-19

If you marked "no" in question 10, do you intend to be vaccinated?

a. ☐ yes, I will do it in the near future
b. ☐ not at the moment, but I don't rule out getting vaccinated in the future
c. ☐ no, never

If you marked "no" in question 10, did you not get vaccinated because:

a. I don't trust vaccines in **general** ☐ yes ☐ no
b. I have no confidence in COVID-19 vaccines ☐ yes ☐ no
c. I was afraid that the vaccine would have a long-term negative impact on my **health** ☐ yes ☐ no
d. feared adverse post-vaccination reactions immediately after vaccination ☐ yes ☐ no
e. I was concerned about the negative impact of vaccination on sports performance ☐ yes ☐ no
f. I didn't have **time to do** it ☐ yes ☐ no
g. I believe that the vaccine against COVID-19 is not necessary ☐ yes ☐ no
h. the trainer/coach told/told me not to **do** it ☐ yes ☐ no
i. I was advised against it by a person working in health care (e.g. doctor, nurse, paramedic). ☐ yes ☐ no
j. ☐ Other than the above *(please specify)* ....

NOTE: questions for all

Please respond to the following statements by marking your answer on a scale where 1 means "strongly disagree" and 5 means "strongly agree."

Vaccination is a very effective way to protect against COVID-19
12345
I know very well how vaccination protects me from COVID-19
12345
Vaccination against COVID-19 is very important to me
12345
Vaccination significantly reduces the risk of contracting COVID-19
12345
I understand how the flu vaccine helps my body fight COVID-19
12345
COVID-19 vaccine plays an important role in protecting my life and the lives of others
12345
I feel pressure to get vaccinated against COVID-19
12345
The impact of COVID-19 vaccine on my health and well-being is very important
12345
I can decide whether I want to be vaccinated with the COVID-19 vaccine or not
12345
How the COVID-19 vaccine protects my health is a mystery to me
12345
I accepted/accepted the COVID-19 vaccine only because I felt obligated to do so
12345
Undergoing COVID-19 vaccine has a positive impact on my health

12345

Who had the greatest influence on your decision to vaccinate or not vaccinate against COVID-19?

a. ☐ Myself/himself
b. ☐ trainer/coach
c. ☐ physician/sports doctor
d. ☐ other athletes
e. ☐ Relatives (family, friends)
f. ☐ other

Is your trainer/coach vaccinated/vaccinated?

a. ☐ yes b. ☐ no c. ☐ don't know

Are your teammates/teammates/training group vaccinated/vaccinated?

a. ☐ yes, all b. ☐ yes, for the most part c. ☐ About half to half d. ☐ no, only some e. ☐ no, no one

Are your adult relatives/family/friends with whom you live vaccinated?

a. ☐ yes, all b. ☐ yes, for the most part c. ☐ About half to half d. ☐ no, only some e. ☐ no, no one

Please respond to the following statements by marking your answer on a scale where 1 means "strongly disagree" and 5 means "strongly agree."

I have no confidence in the government on the issue of COVID-19 vaccination
12345
I don't trust doctors to vaccinate against COVID-19
12345
I don't believe in the effectiveness of the COVID-19 vaccine
12345
Concerned about long-term side effects from COVID-19 vaccine
12345
I have no confidence in the composition of the COVID-19 vaccine
12345
I believe that the COVID-19 vaccines were produced too quickly
12345
I believe that COVID-19 vaccines have not been studied well enough
12345
I believe that COVID-19 is not a dangerous disease
12345
I don't believe in COVID-19 pandemic
12345
Requiring vaccinations restricts civil liberties
12345
I am afraid of a severe COVID-19 that will exclude me from training/work.
12345
Overeating COVID-19 could have long-term effects on my health
12345

Do you consider yourself to be:

a. ☐ Rather, a supporter/advocate of vaccination
b. ☐ Rather, an opponent of/against vaccination
c. ☐ I have no opinion

In your opinion, is your trainer/coach:

a. ☐ Rather, a supporter/advocate of vaccination
b. ☐ Rather, an opponent of/against vaccination
c. ☐ don't know

NOTE: For those not vaccinated against COVID-19, we thank you for completing the survey.

NOTE: the following questions are only for vaccinated persons

Did you experience any discomfort after the vaccine was administered?

24.1 After the first dose:

a. ☐ yes *(please indicate which - you can mark more than one answer)*
   - a.a. ☐ Redness at the injection site
   - a.b. ☐ Swelling/ bruising at the injection site
   - a.c. ☐ high temperature
   - a.d. ☐ headache
   - a.e. ☐ muscle pains
   - a.f. ☐ shudder
   - a.g ☐ malaise/feeling of general wreckage
   - a.h. ☐ other *(please specify)* .....

b. ☐ no, I did not feel/feel any symptoms

24.2 After the second dose: *(not applicable to those vaccinated with only one dose or Johnson & Johnson vaccine)*

a. ☐ yes *(please indicate which - you can mark more than one answer)*
   - a.a. ☐ Redness at the injection site
   - a.b. ☐ Swelling/ bruising at the injection site
   - a.c. ☐ high temperature
   - a.d. ☐ headache
   - a.e. ☐ muscle pains
   - a.f. ☐ shudder
   - a.g ☐ malaise/feeling of general wreckage
   - a.h. ☐ other *(please specify)* .....

b. ☐ no, I did not feel/feel any symptoms

Please enter the month of the first dose .....

Whether because of a suspected adverse vaccine reaction:

a. you have used the doctor's advice ☐ yes ☐ no
b. you have been hospitalized/hospitalized ☐ yes ☐ no

Did the administration of the COVID-19 vaccine affect your training plan?

a. ☐ yes
b. ☐ no *(thank you for completing the survey)*

If you marked "yes" in question 27, please specify for each day in the following tables the degree of training restriction according to the scale, where:

1 means "slight reduction in training"
2 means "a reduction in training that requires a significant change in the training plan"
3 means "no possibility of training

FIRST DOSE or Johnson & Johnson vaccine.

Day 0 is the day the vaccine is administered	Day 0 grafting	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day >7
Training	1 ☐ 2 ☐ 3 ☐	1 ☐ 2 ☐ 3 ☐	1 ☐ 2 ☐ 3 ☐	1 ☐ 2 ☐ 3 ☐	1 ☐ 2 ☐ 3 ☐	1 ☐ 2 ☐ 3 ☐	1 ☐ 2 ☐ 3 ☐	1 ☐ 2 ☐ 3 ☐	1 ☐ 2 ☐ 3 ☐

SECOND DOSE.

Day 0 is the day the vaccine is administered	Day 0 grafting	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day >7
Training	1 ☐ 2 ☐ 3 ☐	1 ☐ 2 ☐ 3 ☐	1 ☐ 2 ☐ 3 ☐	1 ☐ 2 ☐ 3 ☐	1 ☐ 2 ☐ 3 ☐	1 ☐ 2 ☐ 3 ☐	1 ☐ 2 ☐ 3 ☐	1 ☐ 2 ☐ 3 ☐	1 ☐ 2 ☐ 3 ☐

Thank you very much for completing the survey!

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