



# A Descriptive Study of Pain Relief Practices Among Student-Athletes in Palestine: Focus on Non-Steroidal Anti-Inflammatory Drugs, and Complementary Medicine and Alternative Medicine Use

Hala Qasrawi<sup>1</sup> · Siham Assi<sup>1</sup> · Nesma Ghanim<sup>1</sup> · Sa'ed H. Zyoud<sup>2,3,4</sup> · Samah W. Al-Jabi<sup>3</sup>

Accepted: 10 October 2020

© Springer Science+Business Media, LLC, part of Springer Nature 2020

## Abstract

Many athletes suffering from musculoskeletal pain and dysfunction will use some types of complementary and alternative medicine (CAM) or Non-steroidal anti-inflammatory drugs (NSAIDs). Therefore, this study aimed to determine the prevalence, awareness, and behaviors related to NSAIDs and CAM use in Palestinian student-athletes. This was a cross-sectional study that involved 227 students from the Faculty of Sports at An-Najah National University. A self-administered questionnaire was designed in Arabic; it had six sections and a number of open-ended and closed-ended questions. SPSS version 21 was used to analyze the results. Descriptive statistics (i.e., frequencies, percentages) were used to describe the results including demographic characteristics. Overall, 79.3% of the student-athletes had used NSAIDs in the past and 89.0% had used CAM. The CAM methods used by participants were: herbals (57.3%), supplements (32.2%), cupping (11.9%), acupuncture (2.2%), massage (51.5%), yoga (4.0%), praying (18.1%) and ice packs (20.7%). The herbs commonly used by participants were: sage (20.7%), Menthol (21.1%), Aniseed (10.6%), Chamomile (4.0%), Cinnamon (1.3%), Turmeric (4.0%), Ginger (35.7%), and a mixture of herbs (18.5%); Regarding the perceived advantages of CAM use, 82.2% thought that CAM is beneficial for their health, 79.7% thought CAM is safe, 71.3% used it because of the successful experience of others, and 60.9% used it because it's more available than medical therapy. Among NSAIDs users, 17.2% reported recent use of over-the-counter (OTC) NSAIDs, and 33.9% of users used prescribed NSAIDs within the last three months for sport-related reasons. When asked to report any side-effect of NSAIDs they knew, only 22.6% were able to list at least one side-effect. This study shows a high prevalence of NSAIDs and CAM use among student-athletes in Palestine with a low level of knowledge and awareness of their side-effects. Therefore, education strategies that focus on enhancing and improving student-athletes' knowledge of the proper use and the possible side-effects of NSAIDs and CAM are needed.

**Keywords** Non-steroidal anti-inflammatory drugs · Complementary and alternative medicine · Athletes · Students · Palestine

## Introduction

Non-steroidal anti-inflammatory drugs (NSAIDs), have been widely prescribed or used as over-the-counter drugs (OTC) for pain relief by the general population [1]. Their use by athletes in various types of sports has been widely investigated [2–10]. Some research even suggests that as much as 12–36% of athletes use NSAIDs [2, 9, 11–14].

NSAIDs are commonly prescribed for athletic injuries for their anti-inflammatory, analgesic, and antipyretic effects [2–10]. NSAIDs suppress both COX-1 and COX-2 activity, with their non-selectivity contributing to their many side effects [2, 15]. The majority of athletes do not recognize the possible side effects of NSAIDs. Athletes may be prone to more exaggerated side effects, due to their susceptibility to dehydration [9, 16].

Musculoskeletal injuries, which account for the majority of sports-related injuries, cause restriction of activities, and decreased performance among athletes. It has been reported that athletes with minor injuries frequently use inappropriate doses of NSAIDs for prolonged periods, although there is no need for pharmacological treatment [2].

✉ Samah W. Al-Jabi  
samahjabi@yahoo.com; samahjabi@najah.edu

Extended author information available on the last page of the article

For many years, people have used complementary and alternative medicine (CAM), which is not a part of conventional medicine; due to lack of evidence of safety and effectiveness. Yet, it seems that the number of people using CAM is increasing through the years as shown by many studies. Also, it seems that athletes may have the highest prevalence of CAM usage among the population. CAM has been used for its many benefits in improving one's health and well-being. Its benefits include the use of treatment and rehabilitation after injury, pain relief and also improving performance [17–19].

The use of pain killers by athletes from different types of sports has been investigated and described by many authors; some suggest that 12–36% of athletes are using NSAIDs [2, 11, 12]. Globally, many articles have talked about NSAIDs use in sports. In the Arab World, there is a study that discussed the awareness and attitude of analgesics use among the Saudi population [20]. Another study done in Palestine discussed the use of OTC drugs among university students [21]. CAM and herbals use by university students were also investigated by another study conducted in Palestine [22]. Despite the presence of many studies, none of them discussed the use of NSAIDs and CAM among athletes in the Arab world in general and Palestine in particular. According to the global reports of the high prevalence of NSAIDs use, we suspect the presence of such a problem in the athlete population in Palestine; especially in the presence of low knowledge about the accurate use and side effects of NSAIDs.

Therefore, this study aimed: (a) to determine the prevalence of NSAIDs and CAM use in Palestinian student-athletes; (b) to evaluate the level of awareness and behaviors related to NSAIDs use in Palestinian student-athletes; (c) to determine CAM methods used by Palestinian student-athletes; and (d) to evaluate the perceived benefits of CAM use in Palestinian student-athletes.

This study's results will have many benefits for athletes in Palestine. By this research, we aim to provide educational programs to improve knowledge about the pros and cons of NSAIDs and CAM use; which will probably improve the use of NSAIDs and CAM among the athlete population, making them more aware of when and how to use these treatments appropriately.

## Methods

### Study Design

Our research approach uses a cross-sectional survey design in which a targeted questionnaire was prepared for athletes in order to obtain the appropriate answers to contribute to the final results. This study adhered to the STROBE guideline.

### Study Area and Population of the Study

This study was carried out at An-Najah National University, Nablus, West Bank, Northern Palestine. We regularly visited the Faculty of Physical Education to fill out our questionnaire forms. The population included students of the Faculty of Physical Education at An-Najah National University, Nablus, Palestine. According to An-Najah National University records, the number of student-athletes is 520.

### Sample Size and Sampling Technique

The roughly estimated sample size for our study was 225 students out of the eligible students at the Faculty of Physical Education, which was measured using the Raosoft sample size calculator: <https://www.raosoft.com/samplesize.html>.

### Inclusion and Exclusion Criteria

Eligible participants had to fulfill a set of inclusion criteria. These criteria included: Palestinian nationality, student-athletes at An-Najah National University, undergraduate level, willingness to participate, and provided verbal consent to participate in the study.

### Data Collection Instrument

A structured questionnaire was used that included both open-ended and close-ended questions. A self-administered questionnaire was designed in Arabic, based on previous related studies [6, 9, 22–26]. The questionnaire was filled by the participants with the assistance of one of the investigators. Photos of the available local NSAIDs packages were shown to the participants to help them recognize the drugs they may have used. The questionnaire included six sections:

- The first section was the demographic section, which contained questions about age, gender, year of eligibility in sport and primary sport.
- The second section was related to the history of NSAIDs use, including drugs used and frequency of use.
- The third section considered sport-related use in which there were questions related to the pattern of NSAIDs use in relation to sports.
- The fourth section considered behaviors related to NSAIDs use; including reasons for use, from whom they received the drug, and questions related to the dose.
- The fifth section explored general information related to NSAIDs side effects.

- The sixth section explored the use of other methods of pain relief, including CAM. It considered the prevalence of CAM use, types of CAM, and the perceived advantages of CAM use.

## Pilot Study

A pilot study was conducted initially using a primary questionnaire. 20 questionnaires were used and an understanding of the questions by participants was evaluated. Primary results showed a high prevalence of NSAIDs and many improvements were made to the questionnaire to make it more practical.

## Ethical Approval

All aspects of the study protocol were approved by the Institutional Review Boards (IRB) at An-Najah National University, including access to and use of student information. We received written consent from the university chief executive officer of An-Najah National University to collect data from university students. We received verbal consent from each participant before the start of the interview.

## Statistical Analysis

Data were entered and analyzed using the Statistical Package for Social Sciences program version 21 (SPSS). Descriptive statistics (i.e., frequencies, percentages, mean  $\pm$  standard deviation (SD)) were used to describe the results including demographic characteristics. Fisher's exact test and Chi-squared test analyzed data as necessary to assess significance among categorical variables. The level of significance was set at  $p < 0.05$ .

## Results

### Socio-Demographic Information

A total of 227 student-athletes completed questionnaires for this cross-sectional survey study with an average age of 20.4 years [standard deviation = 1.67]. 58.6% of the responding athletes were males and 41.4% were females. Athletes from 4 academic levels participated in this study. Table 1 summarizes the academic levels and sports played by participants (Table 1).

### History of NSAIDs Use

Overall, NSAIDs had been used by 79.3% ( $n = 180$ ) of respondents. There was generally no significant difference in male–female use ( $p$ -value = 0.413). Also, there was no

**Table 1** Socio-demographic characteristics of participants

Variable	N (%)
Gender	
Female	94 (41.4)
Male	133 (58.6)
Academic level	
First year	29 (12.8)
Second year	52 (22.9)
Third year	85 (37.4)
Fourth year	61 (26.9)
Sports played by participants	
Football player	103 (45.4)
Volleyball player	85 (37.4)
Basketball player	54 (23.8)
Table tennis player	35 (15.4)
Marathon player	27 (11.9)
Tennis player	16 (7.0)
Handball player	11 (4.8)
Badminton player	7 (3.1)
Swimming player	4 (1.8)
Taekwondo player	3 (1.3)
Gymnastics player	3 (1.3)
Weightlifting player	2 (0.9)
Boxing player	2 (0.9)

significant difference in the percentage of users between different academic levels ( $p$ -value = 0.775) or different sports (Table 2). A list of names of NSAIDs used by the participants is shown in Table 3.

Incentives of use were variable among participants; 18.9% were influenced by parents or other family members; 11.1% influenced by friends, teammates, or coaches; 2.2% influenced by media (commercials, TV, internet, etc.); 21.1% were self-influenced while 57.2% were prescribed by a doctor or healthcare professional (Fig. 1). Generally, frequent use of NSAIDs was reported by only 8.9% of students, 13.3% used it regularly/ occasionally, 34.4% used it infrequently/irregularly, and 43.9% used it rarely.

### Sport-Related Use of NSAIDs

Among NSAIDs users, 17.2% (31) reported recent use of OTC NSAIDs and 33.9% (61) of users used prescribed NSAIDs within the last three months for sport-related reasons. During the games season, only 4.4% of participants used NSAIDs frequently. Many, however, used it rarely (41.7%) and 27.2% reported that they never used NSAIDs during the game season. Other frequencies are shown in Table 4.

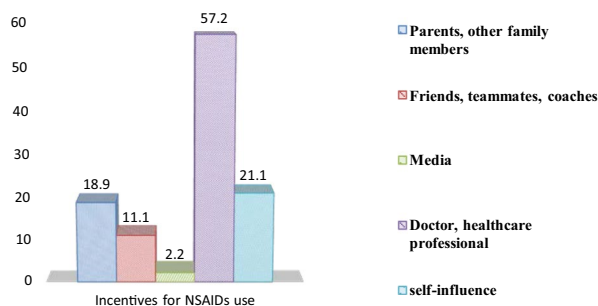
**Table 2** Number of NSAIDs consumers among participants

	NSAIDs user			P value <sup>a</sup>
	Yes (%)	No (%)	Total (%)	
<b>Gender</b>				
Female	77 (42.8)	17 (36.2)	94 (41.4)	0.413
Male	103 (57.2)	30 (63.8)	133 (58.6)	
<b>Academic level</b>				
First year	23 (12.8)	6 (12.8)	29 (12.8)	0.775
Second year	41 (22.8)	11 (23.4)	52 (22.9)	
Third year	65 (36.1)	20 (42.6)	85 (37.4)	
Fourth year	51 (28.3)	10 (21.3)	61 (26.9)	
<b>Sports</b>				
Football	81 (45)	22 (46.8)	103 (45.4)	0.824
Basketball	50 (27.8)	4 (8.5)	54 (23.8)	0.060
Volleyball	68 (37.8)	17 (36.2)	85 (37.4)	0.839
Table tennis	30 (16.7)	5 (10.6)	35 (15.4)	0.308
Marathon	20 (11.1)	7 (14.9)	27 (11.9)	0.476
Tennis	12 (6.7)	4 (8.5)	16 (7.0)	0.660
Handball	9 (5.0)	2 (4.3)	11 (4.8)	0.832
Badminton	7 (3.9)	0 (0.0)	7 (3.1)	0.172
Swimming	4 (2.2)	0 (0.0)	4 (1.8)	0.583
Taekwondo	3 (1.7)	0 (0.0)	3 (1.3)	1.000
Gymnastics	1 (0.6)	2 (4.3)	3 (1.3)	0.110
Weightlifting	2 (1.1)	0 (0.0)	2 (0.9)	1.000
Boxing	2 (1.1)	0 (0.0)	2 (0.9)	1.000

<sup>a</sup>Statistical significance of differences calculated using Chi-square test or Fisher's exact test as appropriate

**Table 3** Distribution of study subjects by type of NSAIDs used

NSAIDs	N (%)
Ibuprofen	144 (80.0)
Diclofenac Na	71 (39.4)
Diclofenac K	68 (37.8)
Naproxen	28 (15.6)
Etoricoxib	15 (8.3)
Piroxicam	6 (3.3)
Celecoxib	5 (2.8)
Indomethacin	3 (1.7)

**Fig. 1** Incentives for NSAIDs' use by student-athletes

## Behaviors Related to NSAIDs Use

Respondents reported the use of NSAIDs in the past for pain relief from injury (35%), recovery (26.7%), cramping (22.2%), general soreness (17.2%), muscle tightness (9.4%), preventing injury or pain (8.9%), and increase energy (2.2%). NSAIDs use was recommended by a doctor in 59.4% of the respondents, other primary sources of NSAIDs are shown in Table 5. Also, Table 5 shows methods of dosage determination and the typical dose of NSAIDs taken at a given time.

## General Information Related to NSAIDs Side Effects

Most participants had never experienced side-effects thought to be related to NSAIDs (91.7%). Side-effects that were experienced by the remaining participants and thought to be related to NSAIDs use are listed in Table 6. On the other hand, when asked to report any side-effect of NSAIDs they knew, only 22.6% were able to list at least one side-effect. Reported side-effects included stomach problems (8.7%); dizziness, headache and general fatigue (13%); liver and kidney problems (4.6%); nausea and vomiting (3.6%); allergy (including rash and dyspnea) (3.6%); and diarrhea (0.5%); (Table 6).

## Other Methods of Pain Relief

Some participants used other methods of pain relief which are illustrated in Fig. 2. 65.2% of them used pain killers other than NSAIDs (e.g., paracetamol, aspirin), 1.3% reported steroid injection use, 36.1% used muscle relaxants, and 89.0% used CAM.

## Types of CAM

The CAM methods used by participants were: herbals (57.3%), supplements (32.2%), cupping (11.9%), acupuncture (2.2%), massage (51.5%), yoga (4.0%), praying (18.1%) and ice packs (20.7%); (Table 7). In general, there was no significant difference in CAM usage between males and females (p-value 0.254). Also, no significant correlation was found between CAM use and type of sport. On the other hand, the results, as shown in Table 8, indicate that there was a significant correlation with the academic levels (p-value = 0.0470).

## Types of Herbs

The herbs commonly used by participants were: sage (20.7%), menthol (21.1%), aniseed (10.6%), chamomile

**Table 4** Sport-related use of NSAIDs

	N (%)
Consumption of OTC NSAIDs within 3 months for sports-related reasons	
Yes	31 (17.2)
No	149 (82.8)
Consumption of prescribed NSAIDs within 3 months for sports-related reasons	
Yes	61 (33.9)
No	119 (60.1)
Frequency of NSAIDs consumption during games season	
Frequent (3–7 times a week)	8 (4.4)
Regular (once a week)	16 (8.9)
Infrequent (once or twice a month)	32 (17.8)
Rare (few times a year)	75 (41.7)
Never	49 (27.2)

(4.0%), cinnamon (1.3%), yurmeric (4.0%), ginger (35.7%) and mixture of herbs (18.5%); (Table 9).

**Table 5** Practices associated with NSAIDs use among participants

Practice	N (%)
Reasons for NSAIDs consumption among users	
Do not use NSAIDs during games season	49 (27.2)
Used for recovery	48 (26.7)
Used for preventing injury or pain	16 (8.9)
Used for pain relief from injury	63(35.0)
Used for general soreness	31 (17.2)
Used for cramping	40 (22.2)
Used for muscle tightness	17 (9.4)
Used to increased energy	4 (2.2)
Reported primary source of NSAIDs	
Self-purchased	24 (13.3)
Recommended by teammates/friends	5 (2.8)
Recommended by a doctor	107 (59.4)
Recommended by a pharmacist	15 (8.3)
Recommended by parents and family	18 (10.0)
Recommended by coaches	11 (6.1)
Method of dosage determination	
According to drug directions	48 (26.7)
Athletic training staff	16 (8.9)
Teammates	3 (1.7)
Doctor	80 (44.4)
Pharmacist	19 (10.6)
Parents	5 (2.8)
Self-determined dose	9 (5.0)
Typical dose of NSAIDs taken at a given time	
Takes one pill	127 (70.6)
Takes 2 pills	44 (24.4)
Takes 4 pills	1 (0.6)
Takes 6 or more pills	1 (0.6)
Takes 400 mg	4 (2.2)
Takes 600 mg	3 (1.7)

### The Motivating Factor Regarding CAM Use

Regarding the perceived advantages of CAM use, 60.4% of the respondents thought that CAM is more effective than medical therapy, 79.7% thought CAM is safe, only 20.3% used it due to failure of medical therapy, 71.3% used it because of the successful experience of others, 60.9% used it because it's more available than medical therapy, 50.5% used it because it's used in the culture and community, 68.8% thought that CAM supports medical therapy and improves its efficacy, 82.2% thought that CAM is beneficial for their health, in 45.5% and 27.7% it was recommended by a doctor or a pharmacist respectively, 67.3% used CAM after learning about it (Fig. 3).

### Discussion

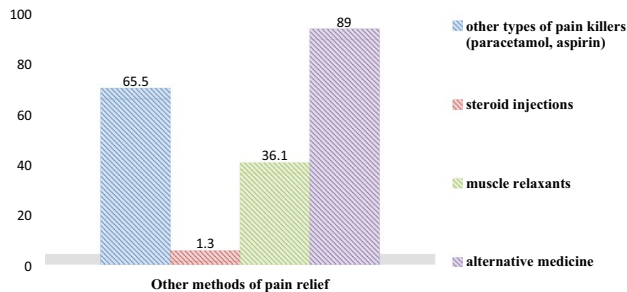
This study shows a high prevalence of NSAIDs' use among student-athletes in Palestine, with a low level of knowledge and awareness regarding their side-effects. Overall, 79.3% of the participants have used NSAIDs in the past, their use is lower than the Irish student-athletes (94.0%) [6], but it's similar to that of the general Polish student collegiate population (77.0%) [27].

Generally, our study showed frequent use of NSAIDs at only 8.9%, while 43.9% used it rarely. However, another study showed that 7.7% of student-athletes reported daily use and 83.7% of them reported rare use [2]. Interestingly, when comparing the general use of them during the competition period. It was found that there was the less frequent use of NSAIDs during the games season. This might be explained by the possibility that most students used NSAIDs



**Table 6** Reported NSAIDs side effects

Side effects	Side effects known by participants: N (%)	Side effects experienced by participants: N (%)
Stomach problems	17 (8.7)	1 (0.6)
Nausea and vomiting	7 (3.6)	1 (0.6)
Dizziness, headache and general fatigue	13 (6.7)	9 (5.0)
Allergy (including rash and dyspnea)	7 (3.6)	5 (2.8)
Liver and kidney problems	9 (4.6)	0 (0)
Diarrhea	1 (0.5)	0 (0)

**Fig. 2** Participant's usage of other methods of pain relief**Table 7** Complementary and alternative medicine methods used by participants

Methods	N (%)
Herbals	130 (57.3)
Supplements	73 (32.2)
Cupping	27 (11.9)
Acupuncture	5 (2.2)
Massage	117 (51.5)
Yoga	9 (4.0)
Praying	41 (18.1)
Ice packs	47 (20.7)

for headache, and dysmenorrhea in girls; and not for sport-related injury.

Most student-athletes bought NSAIDs according to the doctor's direction. Approximately, one-third of them bought NSAIDs by themselves or as advised by their family members, friends or coaches. A previous study stated that those who use non-prescribed medications were more likely to take an overdose of the drug [10]. We were surprised to find that 17.2% of the participants used OTC NSAIDs while 33.9% used prescription, within the last three months, for sports-related reasons. This is inconsistent with the results of other studies that suggest more frequent use of OTC NSAIDs. This may be due to false reporting or easy access to the university doctor [6, 7].

It is important to learn the main reasons for NSAIDs use, and to target interventions for minimizing misuse. In this study, the reasons were: pain relief from injury (35%),

**Table 8** Number of complementary and alternative medicine (CAM) consumers among participants

Variable	CAM user			P value <sup>a,b</sup>
	Yes (%)	No (%)	Total (%)	
<b>Gender</b>				
Female	81 (40.1)	13 (52.0)	94 (41.4)	0.254
Male	121 (59.9)	12 (48.0)	133 (58.6)	
<b>Academic level</b>				
First year	22 (10.9)	7 (28.0)	29 (12.8)	<b>0.047</b>
Second year	50 (24.8)	2 (8.0)	52 (22.9)	
Third year	75 (37.1)	10 (40.0)	85 (37.4)	
Fourth year	55 (27.2)	6 (24.0)	61 (26.9)	
<b>Sports</b>				
Football	93 (46.0)	10 (40.0)	103 (45.4)	0.567
Basketball	49 (24.3)	5 (20.0)	54 (23.8)	0.637
Volleyball	72 (35.6)	13 (52.0)	85 (37.4)	0.111
Table tennis	31 (15.3)	4 (16.0)	35 (15.4)	0.932
Marathon	24 (11.9)	3 (12.0)	27 (11.9)	0.986
Tennis	15 (7.4)	1 (4.0)	16 (7.0)	0.528
Handball	11 (5.4)	0 (0.0)	11 (4.8)	0.232
Badminton	6 (3.0)	1 (4.0)	7 (3.1)	0.779
Swimming	4 (2.0)	0 (0.0)	4 (1.8)	>0.999
Taekwondo	3 (1.5)	0 (0.0)	3 (1.3)	>0.999
Gymnastics	3 (1.5)	0 (0.0)	3 (1.3)	>0.999
Weightlifting	2 (1.0)	0 (0.0)	2 (0.9)	>0.999
Boxing	2 (1.0)	0 (0.0)	2 (0.9)	>0.999

<sup>a</sup>The p-value is bold where it is less than the significance level cut-off of 0.05

<sup>b</sup>Statistical significance of differences calculated using Chi-square test or Fisher's exact test as appropriate

recovery (26.7%), cramping (22.2%), general soreness (17.2%), muscle tightness (9.4%), preventing injury or pain (8.9%), and increase energy (2.2%). These findings are consistent with the previous literature, in which treatment for injury and pain relief were the main reasons for NSAIDs use [2, 28].

Current research proclaims that NSAIDs are primarily indicated as short-term medications for pain relief during rehabilitation and they do not replace active rehabilitation.

**Table 9** Herbs commonly used by participants

Scientific name	Common name	N (%)
Lamiaceae <i>Salvia officinalis L</i>	Sage	47 (20.7)
Lamiaceae <i>Menthapiperita L</i>	Peppermint	48 (21.1)
Apiaceae <i>Pimpinella anisum</i>	Aniseed	24 (10.6)
Asteraceae <i>Matricariachamomilla</i>	Chamomile	9 (4.0)
Lauraceae <i>cinnamomum verum J. persl</i>	Cinnamon	3 (1.3)
Zingiberaceae <i>Curcuma linga L</i>	Turmeric	9 (4.0)
Zingiberaceae <i>Zingiberofficinale roscoe</i>	Ginger	81 (35.7)
	Mixture of herbs	42 (18.5)

In addition, they should not be used prophylactically (in the absence of injury) [29].

Participants displayed poor knowledge of NSAIDs side-effects; only 22.6% were able to list at least one side-effect. Therefore, it's essential that health care professionals, who work with student-athletes, should discuss NSAIDs use & side effects with them and give them the proper recommendations.

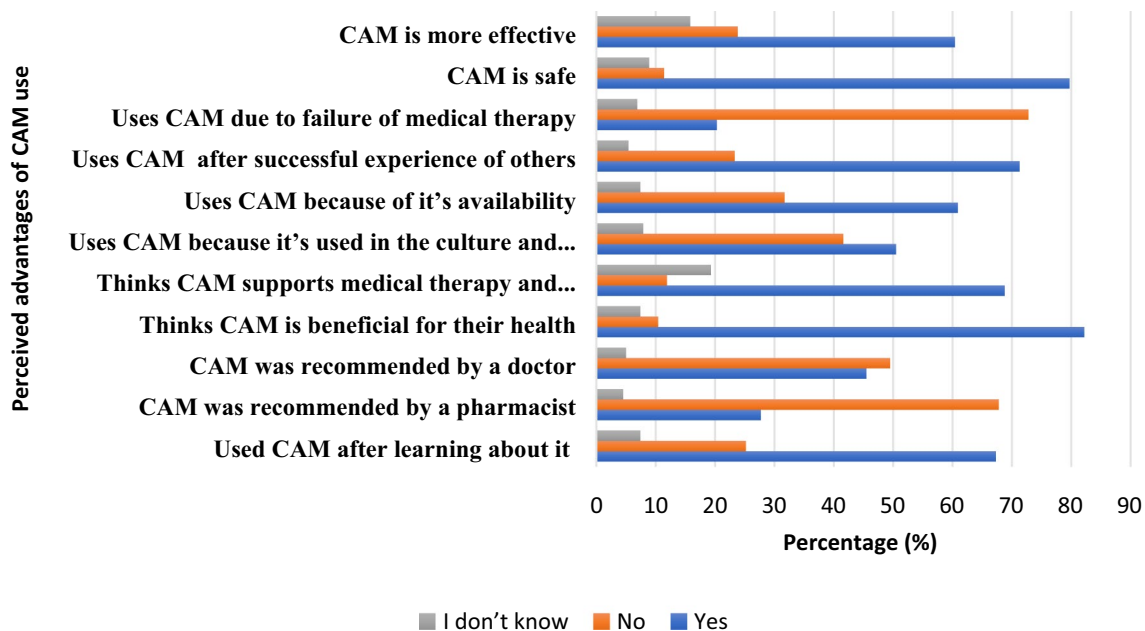
To the best of our knowledge, this is the first study in Palestine that focuses and investigates the use of CAM among student-athletes. We found that the prevalence of

CAM usage was 89% which is higher than student-athletes at the University of Hawaii which was 56% [17]. CAM use was also less prevalent in the general Palestinian population (72.8%) [30] and American adults (62%) [19]. This high prevalence could be attributed to the popularity of CAM in our Islamic and Arabic culture. Also, CAM methods are more available and cost-effective than conventional medicine [22].

Our survey addressed the usage of several CAM forms. Herbals (57.3%) were the most reported, which parallels previous data that showed that such remedies were the most common type of CAM used among Palestinians [22, 30].

There was no significant difference in CAM usage between males and females, which differs from other studies that showed that females use CAM more often than males [17, 19, 22]. There was a significant difference in CAM usage regarding the academic level, the higher the academic level the more they used CAM. These findings, however, were different from those conducted in Hawaii [17]. According to our study, sage was the most common herbal treatment used among student-athletes, which is consistent with the results of another study done in Palestine [22].

Regarding the perceived advantages of CAM use, the most significant result was that 79.7% thought CAM is safe. However, there are many side effects of CAM, for example, herbal remedies may be contaminated with heavy metal or pesticides and research reported serious side effects of herbs, including the cardiac, respiratory, central nervous system, hematologic and liver side effects, and some of them may even cause death [30].

**Fig. 3** Perceived advantages of CAM use over medical therapy

Most participants have used CAM because they thought it is beneficial for their health and that it supports medical therapy. Some of the participants thought that CAM is more effective than conventional medicine. A minority of them used CAM after the failure of medical therapy. A study on the reasons why patients use CAM stated that their use was because CAM is more consistent with their values and beliefs toward health and life, not because of they were dissatisfied with conventional medicine [31].

## Strengths and Limitations

Limitations of this study included: the study was cross-sectional, it was also limited to a convenience sample of athletes, and was carried only in one sitting. Regarding the strengths of our study, it is the first one to investigate pain relief practices among student-athletes in Palestine. Another strength that is worth mentioning is that we had shown participants pictures of different types of NSAIDs common in the Palestinian market while filling the questionnaire; to help the respondents remember which medicine they used and thus overcoming recall bias.

## Conclusions

This study shows a high prevalence of NSAIDs and CAM use among student-athletes in Palestine with a low level of knowledge and awareness regarding their side-effects. It's proven that irresponsible use of painkilling medications will threaten the athlete's health. Therefore, education approaches that concentrate on improving and enhancing the awareness of the proper use of student-athletes and the possible side effects of NSAIDs and CAM are required.

**Acknowledgments** The authors thank retired British Library curator Andy Simons for the English editing of the manuscript. Also, the authors would like to thank students who participated in the survey.

**Author Contributions** HQ, SA and NG collected data, contributed to the study design, conducted the literature search, assisted with data analysis, and helped write the manuscript. SA and SZ conceptualised the study; designed the study, supervised the survey team and data analysis, critically reviewed the manuscript, and interpreted the results. All authors read and approved the final manuscript.

**Funding** The authors received no financial support for the research, authorship, and/or publication of this article.

## Compliance with Ethical Standards

**Conflict of Interest** The authors declare that they have no conflict of interest.

## References

1. Dhabali, A. A., Awang, R., Hamdan, Z., & Zyoud, S. H. (2012). Associations between prescribing nonsteroidal anti-inflammatory drugs and the potential prescription-related problems in a primary care setting. *International Journal of Clinical Pharmacology and Therapeutics*, 50(12), 851–861.
2. Gorski, T., Cadore, E. L., Pinto, S. S., da Silva, E. M., Correa, C. S., Beltrami, F. G., & Krueel, L. F. (2011). Use of NSAIDs in triathletes: prevalence, level of awareness and reasons for use. *British Journal of Sports Medicine*, 45(2), 85–90.
3. Holmes, N., Cronholm, P. F., Duffy, A. J., 3rd., & Webner, D. (2013). Nonsteroidal anti-inflammatory drug use in collegiate football players. *Clinical Journal of Sport Medicine*, 23(4), 283–286.
4. Jones, P., Dalziel, S. R., Lamdin, R., Miles-Chan, J. L., & Frampton, C. (2015). Oral non-steroidal anti-inflammatory drugs versus other oral analgesic agents for acute soft tissue injury. *Cochrane Database Syst Rev*, 7, Cd007789.
5. Matava, M. J. (2018). Injectable nonsteroidal anti-inflammatory drugs in sport. *Clinical Journal of Sport Medicine*, 28(5), 443–450.
6. O'Connor, S., McCaffrey, N., Whyte, E., Moran, K., & Lacey, P. (2019). Nonsteroidal anti-inflammatory drug use, knowledge, and behaviors around their use and misuse in Irish collegiate student-athletes. *Phys Sportsmed*, 47(3), 318–322.
7. Tricker, R. (2000). Painkilling drugs in collegiate athletics: knowledge, attitudes, and use of student athletes. *Journal of Drug Education*, 30(3), 313–324.
8. Warden, S. J. (2010). Prophylactic use of NSAIDs by athletes: a risk/benefit assessment. *Phys Sportsmed*, 38(1), 132–138.
9. Warner, D. C., Schnepf, G., Barrett, M. S., Dian, D., & Swigon-ski, N. L. (2002). Prevalence, attitudes, and behaviors related to the use of nonsteroidal anti-inflammatory drugs (NSAIDs) in student athletes. *Journal of Adolescent Health*, 30(3), 150–153.
10. Wolf, D. A., Miller, T. W., Pescatello, L. S., & Barnes, C. (2011). National collegiate athletic association division I athletes' use of nonprescription medication. *Sports Health*, 3(1), 25–28.
11. Tscholl, P., Alonso, J. M., Dolle, G., Junge, A., & Dvorak, J. (2010). The use of drugs and nutritional supplements in top-level track and field athletes. *American Journal of Sports Medicine*, 38(1), 133–140.
12. Tscholl, P., Junge, A., & Dvorak, J. (2008). The use of medication and nutritional supplements during FIFA World Cups 2002 and 2006. *British Journal of Sports Medicine*, 42(9), 725–730.
13. Wilcox, C. M., Cryer, B., & Triadafilopoulos, G. (2005). Patterns of use and public perception of over-the-counter pain relievers: focus on nonsteroidal antiinflammatory drugs. *Journal of Rheumatology*, 32(11), 2218–2224.
14. Ciocca, M. (2005). Medication and supplement use by athletes. *Clin Sports Med*, 24(3), 719–738.
15. Lippi, G., Franchini, M., Guidi, G. C., & Kean, W. F. (2006). Non-steroidal anti-inflammatory drugs in athletes. *Br J Sports Med*, 40(8), 661–662.
16. Albsoul-Younes, A. M., Jabateh, S. K., Abdel-Hafiz, S. M., & Al-Safi, S. A. (2004). Awareness and frequency of potential side effects on nonsteroidal anti-inflammatory drugs among the Jordanian patient population. *Saudi Medical Journal*, 25(7), 907–911.
17. Nichols, A. W., & Harrigan, R. (2006). Complementary and alternative medicine usage by intercollegiate athletes. *Clinical Journal of Sport Medicine*, 16(3), 232–237.
18. Koh, B., Freeman, L., & Zaslawski, C. (2012). Alternative medicine and doping in sports. *Australasian Medical Journal*, 5(1), 18–25.



19. Barnes, P. M., Bloom, B., & Nahin, R. L. (2008). Complementary and alternative medicine use among adults and children; United States, 2007. *National Health Statistics Reports*, 12, 1–23.
20. Karami, N., Altebainawi, A., Alfarki, S., Aldossari, N., Asiri, A., Aldahan, M., & Alqhtani, T. (2018). Knowledge and attitude of analgesics use among Saudi population: A cross-sectional study. *International Journal of Medical Science and Public Health*, 7(2), 137–143.
21. Sawalha, A. F. (2008). A descriptive study of self-medication practices among Palestinian medical and nonmedical university students. *Research in Social and Administrative Pharmacy*, 4(2), 164–172.
22. Sawalha, A. F., Sweileh, W. M., Zyoud, S. H., & Jabi, S. W. (2008). Self-therapy practices among university students in Palestine: focus on herbal remedies. *Complementary Therapies in Medicine*, 16(6), 343–349.
23. Samara, A. M., Barabra, E. R., Quzaih, H. N., & Zyoud, S. H. (2019). Use and acceptance of complementary and alternative medicine among medical students: a cross sectional study from Palestine. *BMC Complementary and Alternative Medicine*, 19(1), 78.
24. Shraim, N. Y., Shawahna, R., Sorady, M. A., Aiesh, B. M., Alashqar, G. S., Jitan, R. I., et al. (2017). Community pharmacists' knowledge, practices and beliefs about complementary and alternative medicine in Palestine: a cross-sectional study. *BMC Complementary and Alternative Medicine*, 17(1), 429.
25. Zyoud, S. H., Al-Jabi, S. W., Sweileh, W. M., Tabeeb, G. H., Ayaseh, N. A., Sawafta, M. N., et al. (2016). Use of complementary and alternative medicines in haemodialysis patients: a cross-sectional study from Palestine. *BMC Complementary and Alternative Medicine*, 16, 204.
26. Davis, B. R. (2015). *Non-steroidal anti-inflammatory drug use in collegiate athletes*. Portland, OR: Portland State University.
27. Wawryk-Gawda, E., Chylinska-Wrzos, P., Lis-Sochocka, M., & Jodlowska-Jedrych, B. (2014). Consumption and awareness of students about nonsteroidal anti-inflammatory drugs. *Curr Issues Pharm Med Sci*, 27(3), 175–178.
28. Huang, S. H., Johnson, K., & Pipe, A. L. (2006). The use of dietary supplements and medications by Canadian athletes at the Atlanta and Sydney Olympic Games. *Clinical Journal of Sport Medicine*, 16(1), 27–33.
29. Warden, S. J. (2009). Prophylactic misuse and recommended use of non-steroidal anti-inflammatory drugs by athletes. *British Journal of Sports Medicine*, 43(8), 548–549.
30. Sawalha, A. F. (2007). Complementary and alternative medicine (CAM) in Palestine: use and safety implications. *Journal of Alternative and Complementary Medicine*, 13(2), 263–269.
31. Astin, J. A. (1998). Why patients use alternative medicine: results of a national study. *The Journal of the American Medical Association*, 279(19), 1548–1553.

**Publisher's Note** Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

## Affiliations

Hala Qasrawi<sup>1</sup> · Siham Assi<sup>1</sup> · Nesma Ghanim<sup>1</sup> · Sa'ed H. Zyoud<sup>2,3,4</sup> · Samah W. Al-Jabi<sup>3</sup>

Hala Qasrawi  
hala.qasrawi@yahoo.com

Siham Assi  
sihamassi@yahoo.com

Nesma Ghanim  
nasmaghanem@gmail.com

Sa'ed H. Zyoud  
saedzyoud@yahoo.com

<sup>2</sup> Poison Control and Drug Information Center (PCDIC), College of Medicine and Health Sciences, An-Najah National University, Nablus 44839, Palestine

<sup>3</sup> Department of Clinical and Community Pharmacy, College of Medicine and Health Sciences, An-Najah National University, Nablus 44839, Palestine

<sup>4</sup> Clinical Research Centre, An-Najah National University Hospital, Nablus 44839, Palestine

<sup>1</sup> Department of Medicine, College of Medicine and Health Sciences, An-Najah National University, Nablus 44839, Palestine