Alternative medicine and doping in sports

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REVIEW

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Abstract

Athletes are high achievers who may seek creative or unconventional methods to improve performance. The literature indicates that athletes are among the heaviest users of complementary and alternative medicine (CAM) and thus may pioneer population trends in CAM use. Unlike non-athletes, athletes may use CAM not just for prevention, treatment or rehabilitation from illness or injuries, but also for performance enhancement. Assuming that athletes' creative use of anything unconventional is aimed at "legally" improving performance, CAM may be used because it is perceived as more "natural" and erroneously assumed as not potentially doping. This failure to recognise CAMs as pharmacological agents puts athletes at risk of inadvertent doping.

The general position of the World Anti-Doping Authority (WADA) is one of strict liability, an application of the legal proposition that ignorance is no excuse and the ultimate responsibility is on the athlete to ensure at all times whatever is swallowed, injected or applied to the athlete is both safe and legal for use. This means that a violation occurs whether or not the athlete intentionally or unintentionally, knowingly or unknowingly, used a prohibited substance/method or was negligent or otherwise at fault. Athletes are therefore expected to understand not only what is prohibited, but also what might potentially cause an inadvertent doping violation. Yet, as will be discussed, athlete knowledge on doping is deficient and WADA itself sometimes changes its position on prohibited methods or substances. The situation is further confounded by the conflicting stance of anti-doping experts in the media. These highly publicised disagreements may further portray inconsistencies in anti-doping guidelines and suggest to athletes that what is considered doping is dependent on the dominant political zeitgeist. Taken together, athletes may believe that unless a specific and explicit ruling is made, guidelines are open to interpretation. Therefore doping risk-taking behaviours may occur because of the potential financial, social and performance gains and the optimistically biased interpretation (that trying alternatives is part of the "spirit of sport") and doping risk-taking behaviours may occur.

This discussion paper seeks to situate the reader in a world where elite level sports and CAM intersects. It posits that an understanding of the underlying motivation for CAM use and doping is currently lacking and that anti-doping rules need to be repositioned in the context of the emerging phenomenon and prevalence of CAM use.

Key Words
Doping, complementary and alternative medicine, sports law, biopsychology

Background

Western medicine as is practiced in many industrialised countries is generally regarded as conventional, or orthodox, and its use has a long-established history in these societies.[1] Interest and use of complementary and alternative medicine (CAM) has, however, been growing in recent times in Western countries, as reflected by the increasing number of research papers in medical and scientific journals [unpublished literature search by the

authors. Interested readers are referred also to the following for further details:].[2-10]

Surveys in many countries have suggested a high use of CAM: in the United States, about a third of adults aged 18 years or older use CAM.[9,11] Despite this growing interest, the definition of what is complementary or alternative remains very subjective and is certainly not universally accepted.[12]

While individual organisations have their own definitions, the perceptions of the general population or the end-users and even the practitioners of the various forms of medicine of what constitutes CAM vary tremendously.[12] In addition, CAM techniques could become co-opted as they enter the mainstream.[13] More physicians are also seeking training in CAM: there is an estimated 3,000 American physicians who integrate acupuncture into their practice[14] and an estimated one-third of homeopaths who are physicians or osteopaths.[15] The confusion of what constitute CAM (and the increasing penetration of CAM in everyday life) – either as a distinct treatment modality that consumers actively choose, or through the integration of CAM into Western medicine – may have serious implications for athletes.

Athletes are highly motivated and many seek new methods to improve performance. The literature indicates that athletes may also be the highest users of CAM and may help pioneer population trends in CAM use.[16-18] While non-athletes may use CAM for prevention, treatment or rehabilitation from illness/injuries, athletes may possibly also use CAM for performance enhancement. If links between sport motivation and doping exist, and athletes' sport motivation and CAM use are related, a connection between athletes' CAM use and doping may also occur. This paper seeks to situate the reader in a world where elite level sports and CAM intersects and posits that anti-doping rules need to be repositioned in the context of an emerging phenomena and ubiquitous prevalence of CAM use. This paper discusses the concept of doping, the issue of using natural substances as a doping violation, how acupuncture as a type of CAM works, and how the use of CAM may be related to doping in the formal context of the spirit of sport.

It is important to note that most international sports are governed by rules of Western nations and Western culture and philosophies. For example, the rules for competitive swimming and all aquatic sports are governed by Fédération Internationale de Natation (FINA), while anti-doping rules in all sports are governed by the World Anti-Doping Agency (WADA). The official languages (and the inherent culture and worldview) of FINA and the WADA rules are English and French and where the interpretations of the rules are in doubt, the English language shall prevail. [19-21]

With an increase in the participation of non-Westernised countries in international sports, these rules (especially those regarding anti-doping) and their interpretation need to be sensitive to a multi-cultural environment. This paper will also explore how biopsychological evidence in the contexts of CAM use and WADA rules need to be more consistent and better explained to the sporting community.

What is doping?

It was mentioned earlier how the WADA is the current international governing body that oversees the issue of doping in all sports. The WADA has defined doping in their World Anti-Doping Code (the "Code", 22). Under the Code, a violation of one or more of the following rules is considered doping and may result in sanction: (i) the presence of a prohibited substance or its metabolites or markers in an athlete's bodily specimen, (ii) the use or attempted use of a prohibited substance or a prohibited method, (iii) possession of prohibited substances and methods, (iv) administration or attempted administration of a prohibited substance or prohibited method to any athlete, or (v) assisting, encouraging, aiding, abetting, covering up or any other type of complicity involving an anti-doping rule violation or any attempted rule violation.

A substance or *method* is considered for inclusion on the WADA's prohibited list if the WADA determines that the substance or *method* meets any two of the following three criteria (italics emphasis by this author):[22]

1. Medical or other scientific evidence, pharmacological effect, or experience that the substance or method has the *potential* to enhance or enhances sport performance.
2. Medical or other scientific evidence, pharmacological effect, or experience that the use of the substance or method represents an actual or *potential* health risk to the athlete.
3. Determination by the WADA that the use of the substance or method violates the spirit of sport as described in the 'Introduction to the Code' (further explored below).[22]

The current emphasis of prohibition also appears to be based on four factors:

1. Substances within the athlete's body.
2. Methods that enhance oxygen transfer through blood doping or artificial measures.

3. Altering collected body fluid samples.
4. Genetic manipulation.

This paper discusses the first two factors. Controversy exists as to what are acceptable levels of naturally occurring endogenous compounds and also what is a *method* that is not considered doping.

The interpretation of the Code is a legal one and largely untested. The broad interpretation of the principles behind the Code would seem to be related to any substance or *method* that (potentially or actually) enhances sport performance, becomes a health threat to the athlete, or is against the spirit of the sport. If the motivation, and indeed, the imperative, of an athlete is to constantly seek creative ways to improve the sporting performance, what then is the *spirit of sport,* and what actions are deemed to have violated that spirit? Using a biopsychological perspective, issues of what are acceptable levels of naturally occurring endogenous compounds, what is a *method* that is not considered doping, and what is the *spirit of sport* are explored below.

What is unnatural about natural substances?

Calf-derived deproteinised haemodialysate, Actovegin (Nycomed Austria), is a component in calves' blood that gained attention when its use by the Australian rugby teams was reported[23] to improve endurance and recovery from injuries. Although the medical research suggests some evidence (i.e. *'potential'*) of efficacy in the treatment of soft tissue injuries,[24,25] the Australian Sports Anti-Doping Authority (ASADA, as a national representative of the international parent, WADA) said that Actovegin was not then on the WADA's list of prohibited substances.[26] Thus its use as a substance when restricted to intra-muscular injections is therefore not prohibited. However, it is illegal as a *method* when injected into a vein.[27,28]

Actovegin was initially listed on the banned list by the International Olympic Committee (IOC) (the leading authority in anti-doping prior to the formation of the WADA) in December 2000 because of the concerns about its abuse in cycling. It was, however, removed from the IOC banned list in February 2001 pending further research.[28] Actovegin is not a prohibited substance in WADA's most current lists,[20,21] although these lists do have an inclusion statement not present in previous versions: the prohibition of any growth factor(s) affecting muscle, tendon or ligament protein synthesis/degradation, vascularisation, energy utilisation, regenerative capacity or fibre type switching (p. 4). This inclusion statement has, however, created more uncertainty over other therapeutic substances, besides Actovegin, used in sports medicine settings [e.g. platelet-rich plasma: discussed in more detail by Engebretsen et al].[29] So far, the lawful challenge of using Actovegin as a tendon healing substance has not been made, although this legal issue is evolving at the time of writing.[30]

According to the latest 2012 WADA prohibited list,[21] Actovegin is not prohibited in any sports. However, to complicate matters, WADA has issued specific guidance on Actovegin on its website that, according to section M2 of the WADA code, the volume of intravenous injection of any non-prohibited substance must not exceed 50 ml with a simple syringe, and further serial injections must be at least six hours apart.[31] This means that under the latest (2012) interpretation of the Code, Actovegin cannot be administered by intravenous infusion or single intravenous injection with a volume exceeding 50 ml.

Erythropoietin (EPO) is a peptide hormone and another compound that is found in the blood. EPO occurs naturally in the human body. To boost the amount of EPO in the human body with the aim of improving endurance performance or to improve recovery from anaerobic exercise, some athletes (e.g. cyclists) may use recombinant EPO. Recombinant EPO is prohibited both in and out of competition under the World Anti-Doping Code Prohibited List, [20] although raising endogenous EPO in an athlete's body through the *method* of high altitude training is not prohibited.

Recombinant EPO use, traditionally difficult to detect in the athlete, has recently been successfully tested in athletes as a result of collaboration of WADA and the pharmaceutical companies in uncovering a molecular marker of the drug.[32] This uncovering process helps differentiate naturally occurring EPO and those artificially introduced. A similar technique to detect Actovegin would not be useful if the artificial introduction into the human body intramuscularly or using less than 50ml volume (no specification of concentration by WADA) intravenously were not prohibited. This means that the detection of doping of Actovegin would depend on catching athletes in the act of performing the banned *method* (not adhering to the rule of an intravenous injection of less than 50ml or an intramuscular injection of Actovegin) and not simply detecting Actovegin in the athlete's body.

The inclusion and subsequent exclusion from the prohibited list, coupled with confusing biological evidence and scientific perspective is not unique to Actovegin: caffeine, considered a performance enhancing substance, was also previously classified as a banned substance by WADA if it

was detected in urine above a concentration of 12 micrograms per millilitre. Subsequent scientific evidence suggests that caffeine actually decreases performance above that 12 micrograms per millilitre threshold,[33] and is known to be metabolised at very different rates in individuals. Thus the risks of sanctioning athletes for simply consuming social amounts of caffeine common in drinks and food[33] led to the removal of caffeine from WADA's list of banned substance in 2004. [33]

The inconsistent stances on substances and methods illustrated above may confuse athletes, particularly when interpreted in the context of the *spirit of sport* (discussed later). This confusion may be exacerbated by consistent media portrayal of differences on the legalities of using Actovegin and caffeine in sports by anti-doping experts.[33.,34]

The next section will discuss various possible ways that acupuncture (as a form of CAM) works physiologically. In the setting of expert debate on acceptable levels of naturally occurring endogenous compounds and what is a *method* that is not considered doping, it provides a biopsychological basis in the context of doping and spirit of sport.

CAM physiology and methods

Acupuncture [and the field of traditional Chinese medicine (TCM)] is arguably an archetype of what is considered CAM in Westernised societies.[35] Acupuncture is also increasingly being integrated into conventional medicine in these communities and is one of the most extensively scientifically studied forms of CAM.[12]

While there is still debate on the actual physiological mechanism of how acupuncture works, many scientists believe that several mechanisms are possible. Because these proposed mechanisms are different from the underlying ethos and philosophy that govern acupuncture and TCM – the presence of the life energy (or "*Qi*") flowing through channels (or "*meridians*") in the human body[36] – and how disease occur, direct comparisons with the scientific paradigms of biomedicine are not always possible.[37] Also, individuals may use CAM and TCM due to their beliefs in the underlying traditional philosophies rather than any scientific motivation. [38]

There are several ways in which acupuncture may work. Local anaesthesia at needle insertion sites may block the analgesic effects of acupuncture which suggests that acupuncture is dependent upon neural innervation.[39] Acupuncture may also cause the release of endogenous opioids in brain-stem, subcortical, and limbic structures[40,41] or induce the secretion of adrenocorticotropic hormone and cortisol from the pituitary gland thereby creating a systemic anti-inflammatory response.[42] Indeed, functional MRI studies in humans show that acupuncture modulates limbic and basal forebrain areas involved in pain processing,[43] while PET (positron-emission tomography) scans have shown that acupuncture is able to increase the opioid binding potential in the brain for several days.[44]

Other proposed mechanisms of how acupuncture works are through its ability to mechanically stimulate connective tissues,[45] release adenosine at the site of needle stimulation,[46] or increase local blood flow.[47] Ahmedov[48] provides a more detailed discussion of the potential ergogenic effects of acupuncture in sport and exercise. As an example, an athlete sustained a ruptured muscle fibre (traditionally requiring prolonged treatment periods) less than three weeks before the 1998 European track and field championship. Treated with acupuncture, the athlete went on to win a silver medal and maintained a high performance level without pain.[49]

Evidence-based medicine requires large sample sizes and preferably randomised-controlled trials to provide statistical evidence of significant effects. The issue of doping, however, is as much an interpretation of the law, as it is about the scientific and statistical evidence. The Code states that *"…regardless of whether the expectation of performance enhancement is realistic..".*[22] This is discussed in the next section.

Regardless of how acupuncture works, if a CAM modality such as acupuncture that does not involve ingestion of (potentially prohibited) substances but operates via a physical *method*, is capable of (*potentially*) increasing an athlete's endorphin levels or increasing the athlete's tissue regenerative capacity [and in so doing *potentially* improves athlete performance],[50] is it acceptable under WADA rules? Or is it against WADA's spirit of sport?

Spirit of sport: The ephemeral elephant in the room

The WADA characterises *spirit of sport* under the Code[22] (p.14) as:

1. ethics, fair play and honesty;
2. health;
3. excellence in performance;
4. character and education;
5. fun and joy;
6. teamwork; dedication and commitment;
7. respect for rules and laws;
8. respect for self and other participants;

9. courage;
10. community and solidarity.

While these objectives are noble and worthy principles for sport, their abstract nature sometimes creates confusion when applied to the day-to-day realities that athletes face. The Code cites specific issues in the context of the spirit of sport, but these add to the confusion.

The WADA states in the Code (9) that the:

> "… use of genetic transfer technology to dramatically enhance sport performance should be prohibited as contrary to the spirit of sport *even if it is not harmful*..."

and that

> "… the potentially unhealthy abuse of certain substances without therapeutic justification based on the mistaken belief they enhance performance is certainly contrary to the spirit of sport *regardless of whether the expectation of performance enhancement is realistic*…" (p.33, italics by this author for emphasis).

These seem at *prima facie* to contradict the guiding principle of 'excellence in performance' set out in the characterisation of *spirit of sport* in the introduction to the Code (p. 14).

Athletes dedicate their lives to improving their sporting skills and fitness to be better in their sport. It is acceptable (and logical) to enhance performance by physical training without adding substances to the athlete's body. The use of varied training programs and orthotic devices by athletes (e.g. fins for swimming training) during out-of-competition training is standard practice for most sports and one of the fundamentals of training paradigms. Most such performance-enhancing devices are, however, banned during competition.

If performance enhancing devices are prohibited during competition, how is the previous acceptance of performance enhancing polyurethane swim suits by the international swimming governing body, FINA,[51,52] or the recent acceptance of a performance enhancing "swimwear system" for the 2012 Olympics[53] reconciled with WADA's *spirit of sport* and FINA's own rule of 'No swimmer shall be permitted to use or wear any device that may aid his speed, buoyancy or endurance during a competition' (FINA, 54, SW 10.8)? Extending that argument a little further, and in the context of CAM, if a CAM that uses a physical modality is able to enhance performance, regardless of whether the expectation of performance enhancement is realistic,[22] is that deemed acceptable and in the spirit of sport, or does it violate WADA's doping regulations? Should the use of acupuncture, for example, to speed up recovery, improve flexibility and improve performance during a competition be labelled as a prohibited *method* and/or against the spirit of sport?

The finishing line

If the psychological motivation of athletes is to excel in their sport, and there may be a biopsychological basis for using CAM to improve their performance, the implications of CAM use in the context of elite sport must be recognised.

Whether using conventional medicine or CAM, athletes utilise any means to maximise their physical potential. So when does a method that increases the athletes' endogenous substance to improve sporting performance become illegal or against the spirit of sport? There is at present an inconsistent application of what are *methods* that are considered illegal or doping and what the spirit of sport really is.

Present day elite sport culture is now less about health, courage, community and solidarity, or even character and education, fun or joy. The majority of athletes presumably believe and strive for ethics, fair play, honesty, and most are mindful of respecting themselves, the other participants, and showing teamwork, and will not knowingly break the rules and the law. While few would disagree that elite athletes epitomise the virtues of dedication and commitment, their ultimate and fundamental motivation is ultimately excellence in sporting performance.

Data from non-athlete patients suggests that ingested CAM substances are not viewed as medications because they are perceived as "natural".[55-58] Thus athletes may use CAM in the belief that it is more natural and, erroneously, not potentially doping (either as a "method" or "substance" under the anti-doping Code). The lack of understanding of various forms of medicine by patients and athletes may result in their not informing doctors (or coaches) about non-conventional treatment use because it is not viewed as important or relevant to their medical management.[59] Patients thus risk complications from CAM drugs and their interaction with prescribed medications.[60-64] The additional consequence from failure to recognise CAMs as pharmacological agents puts athletes at risk of inadvertent doping.

References

1. Grace S, Rogers S, Eddy S. The natural medicine workforce: Terms in public use. JATMS. 2011;17(3):139-42.
2. Fulder SJ, Munro RE. Complementary medicine in the United Kingdom: Patient practitioners, and consultations. Lancet. 1985;2:252-545.
3. Eisenberg DM, Davis RB, Ettner SL, Appel S, Wilkey S, Van Rompay M. Trends in alternative medicine use in the United States, 1990–1997. JAMA. 1998;280(18):1569-75.
4. Australian Bureau of Statistics. Australian social trends: Complementary therapies. Canberra: Australian Bureau of Statistics; 2008.
5. MacLennan AH, Myers SP, Taylor AW. The continuing use of complementary and alternative medicine in South Australia: costs and beliefs in 2004. Med J Aust. 2006 Jan 2;184(1):27-31.
6. Sirois FM, Gick ML. An investigation of the health beliefs and motivations of complementary medicine clients. Soc Sci Med. 2002;55(6):1025-37.
7. Leung S, Chan K, Song L. Publishing trends in Chinese medicine and related subjects documented in WorldCat. Health Information & Libraries Journal. 2006;23(1):13-22.
8. Han JS, Ho YS. Global trends and performances of acupuncture research. Neurosci Biobehav Rev. 2011;35(3):680-7.
9. Barnes PM, Bloom B, Nahin RL. Complementary and alternative medicine use among adults and children: United States, 2007. National Health Statistics Reports; no 12. Hyattsville, MD: National Center for Health Statistics; 2008.
10. Barnes J, Abbot NC, Harkness EF, Ernst E. Articles on complementary medicine in the mainstream medical literature: An investigation of MEDLINE, 1966 through 1996. Arch Intern Med. 1999 Aug 9-23;159(15):1721-5.
11. Barnes PM, Powell-Griner E, McFann K, Nahin RL. Complementary and alternative medicine use among adults: United States, 2002. Semin Integr Med. 2004 May 27;2(2):54-71.
12. Tovey P, Easthope G, Adams J. The mainstreaming of complementary and alternative medicine: Studies in social context: Routledge; 2004.
13. Goldner M. Integrative medicine: issues to consider in this emerging form of health care. Res Sociol Health Care. 2000;17:213-33.
14. Langone J. Challenging the mainstream. Time. 1996:40-3.
15. Dranov P. Alternative medicine: What helps, what hurts. LHG. 1996(November):94-9.
16. White J. Alternative sports medicine. Physician Sports Med. 1998;26:92-105.
17. Koh B. Athlete motivation and healthcare choices: A study into factors influencing athletes use of conventional, complementary and alternative medicine in Australia. Unpublished research. University of Technology Sydney; 2008.
18. Koh B, Freeman L, Jonson P, Zaslawski C. Culture, knowledge, 'Spirit of Sport': Understanding alternative therapy use and doping in aquatic-sports. Australia: Department of Health and Ageing, Australian government; 2010.
19. Fédération Internationale de Natation (FINA). Constitution 2009-2013. FINA Handbook 2009-2013 [serial on the Internet]. 2009: Available from: http://www.fina.org/project/index.php?option=com_content&task=view&id=42&Itemid=119.
20. World Anti-Doping Agency. The 2011 Prohibited List2011; (1 January 2011): Available from: http://www.wada-ama.org/Documents/World_Anti-Doping_Program/WADP-Prohibited-list/To_be_effective/WADA_Prohibited_List_2011_EN.pdf.
21. World Anti-Doping Agency. The 2012 Prohibited List: Effective 1 Jan 20122011; (24 August 2011): Available from: http://www.wada-ama.org/Documents/World_Anti-Doping_Program/WADP-Prohibited-list/To_be_effective/WADA_Prohibited_List_2012_EN.pdf.
22. World Anti-Doping Agency. World anti-doping code2009: Available from: http://www.wada-ama.org/rtecontent/document/code_v2009_En.pdf.
23. Santow S. Blood doping on the rise. The World Today. Australia: ABC Local Radio; 2008.
24. McLauchlan GJ, Handoll HH. Interventions for treating acute and chronic achilles tendinitis. Cochrane Database Syst Rev 2001;2(CD000232).
25. Lee P, Kwan A, Nokes L. Actovegin: Cutting-edge sports medicine or "voodoo" remedy? Current Sports Medicine Reports. 2011;10(4):186-90.
26. World Anti-Doping Agency. The 2008 Prohibited List2008; (1 January 2008): Available from: http://www.wada-ama.org/Documents/World_Anti-Doping_Program/WADP-Prohibited-list/WADA_Prohibited_List_2008_EN.pdf.
27. Ritchie D, Morrissey T. Manly admits to cows' blood injections. The Daily Telegraph. 2008 3 July 2008.
28. Tsitsimpikou C, Tsiokanos A, Tsarouhas K, Schamasch P, Fitch KD, Valasiadis D, Jamurtas, A. Medication use by athletes at the Athens 2004 summer Olympic games. Clin J Sport Med. 2009;19(1):33-8.
29. Engebretsen L, Steffen K, Alsousou J, Anitua E, Bachl N, Devilee R, Everts P, Hamilton B, Huard J, Jenoure P, Kelberine F, Kon E, Maffulli N, Matheson G, Mei-Dan O, Menetrey J, Philippon M, Randelli P, Schamasch P, Schwellnus M, Vernec A, Verrall G. IOC consensus paper on the use of platelet-rich plasma in sports medicine. Br J Sports Med. 2010 December 1, 2010;44(15):1072-81.

30. Blackwell T. Canadian doctor in sports-doping scandal has been unfairly punished, lawyer says. National Post. 2011 7 December.
31. World Anti-Doping Agency. Questions & answers on 2012 prohibited list: What is the status of actovegin? 2011 [updated September; cited 2011 28 December]; Available from: http://www.wada-ama.org/en/World-Anti-Doping-Program/Sports-and-Anti-Doping-Organizations/International-Standards/Prohibited-List/QA-on-2012-Prohibited-List/.
32. Sillup M. Roche says it didn't add molecule to drug found in cyclist test Bloomberg News. 2008 23 July 2008.
33. Salleh A. Athletes' caffeine use reignites scientific debate. ABC News. 2008 2 Aug 2008.
34. Barrett D. Woods's doctor to face drug charges. The Sydney Morning Herald. 2009 18 Dec 2009.
35. Koh B, Freeman L, Jonson P, Zaslawski C. Athlete healthcare behaviour: An ethnographer's methodological conundrum. The 4th annual joint University of Liverpool Management School and Keele University Institute for Public Policy and Management Symposium on Current Developments in Ethnographic Research in the Social and Management Sciences; Liverpool, UK 2009.
36. Mayer DJ. Acupuncture: An evidence-based review of the clinical literature. Annu Rev Med. 2000;51(1):49-63.
37. Langevin HM, Yandow JA. Relationship of acupuncture points and meridians to connective tissue planes. Anat Rec. 2002;269(6):257-65.
38. Caspi O, Koithan M, Criddle MW. Alternative medicine or alternative patients: A qualitative study of patient-oriented decision-making processes with respect to complementary and alternative medicine. Med Decis Making. 2004 January 1, 2004;24(1):64-79.
39. Wang SM, Kain ZN, White P. Acupuncture analgesia: I. The scientific basis. Anesth Analg. 2008;106(2):602-10.
40. Han JS. Acupuncture: Neuropeptide release produced by electrical stimulation of different frequencies. Trends Neurosci. 2003;26(1):17-22.
41. Pomeranz B. Scientific research into acupuncture for the relief of pain. J Altern Complement Med. 1996;2(1):53-60.
42. Li A, Lao L, Wang Y, Xin J, Ren K, Berman B, et al. Electroacupuncture activates corticotrophin-releasing hormone-containing neurons in the paraventricular nucleus of the hypothalammus to alleviate edema in a rat model of inflammation. BMC Complement Altern Med. 2008;8(1):20.
43. Dhond RP, Kettner N, Napadow V. Neuroimaging acupuncture effects in the human brain. J Altern Complement Med. 2007;13(6):603-16.
44. Harris RE, Zubieta JK, Scott DJ, Napadow V, Gracely RH, Clauw DJ. Traditional Chinese acupuncture and placebo (sham) acupuncture are differentiated by their effects on [mu]-opioid receptors (MORs). Neuroimage. 2009;47(3):1077-85.
45. Langevin HM, Churchill DL, Wu J, Badger GJ, Yandow JA, Fox JR, et al. Evidence of connective tissue involvement in acupuncture. The FASEB journal. 2002;16(8):872.
46. Goldman N, Chen M, Fujita T, Xu Q, Peng W, Liu W, et al. Adenosine A1 receptors mediate local anti-nociceptive effects of acupuncture. Nat Neurosci. 2010;13(7):883-8.
47. Sandberg M, Lundeberg T, Lindberg LG, Gerdle B. Effects of acupuncture on skin and muscle blood flow in healthy subjects. Eur J Appl Physiol. 2003;90(1):114-9.
48. Ahmedov S. Ergogenic effect of acupuncture in sport and exercise: A brief review. JSCR. 2010;24(5):1421-7.
49. Schwanitz R. Acupuncture and related methods spplied in sports medicine: Exemplified by the rupture of a muscle fiber. Medical Acupuncture. 2007;19(2):105-8.
50. Pelham T, Holt L, Stalker R. Acupuncture in human performance. The Journal of Strength and Conditioning Research. 2001;15(2):266-71.
51. Cowley M. Get set for another record - the world record for world records. The Sydney Morning Herald. 2008 August 14, 2008.
52. The Associated Press. FINA approves new swimsuits from Arena, Adidas and Mizuno. International Herald Tribune. 2008 June 4, 2008.
53. Pearce N. Olympic swimming records set to tumble at London 2012 as Speedo unveil Fastskin3 swimwear system. The Telegraph. 2011 30 November.
54. Fédération Internationale de Natation (FINA). Swimming Rules SW 10.8. FINA Handbook 2009-2013 [serial on the Internet]. 2009: Available from: http://www.fina.org/project/index.php?option=com_content&task=view&id=45&Itemid=119.
55. Bair YA, Gold EB, Zhang G, Rasor N, Utts J, Upchurch DM, Chyu L, Greendale GA, Sternfeld B, Adler SR. Use of complementary and alternative medicine during the menopause transition: Longitudinal results from the Study of Women's Health Across the Nation. Menopause. 2008;15(1):32-43.
56. Vlieger AM. Complementary therapies in paediatric gastroenterology: Prevalence, safety and efficacy studies. Amsterdam: University of Amsterdam; 2009.
57. Jones L, Sciamanna C, Lehman E. Are those who use specific complementary and alternative medicine therapies less likely to be immunized? Prev Med. 2010;50(3):148-54.
58. Nichol J, Thompson EA, Shaw A. Beliefs, decision-making, and dialogue about complementary and alternative medicine (CAM) within families using CAM: A qualitative study. J Altern Complement Med. 2011;17(2):117-25.
59. Chao M, Wade C, Kronenberg F. Disclosure of complementary and alternative medicine to conventional

medical providers: Variation by race/ethnicity and type of CAM. J Natl Med Assoc. 2008;100(11):1341.
60. Werneke U, Earl J, Seydel C, Horn O, Crichton P, Fannon D. Potential health risks of complementary alternative medicines in cancer patients. Br J Cancer. 2004;90(2):408-13.
61. Stevenson FA, Britten N, Barry CA, Bradley CP, Barber N. Self-treatment and its discussion in medical consultations: how is medical pluralism managed in practice? Soc Sci Med. 2003;57(3):513-27.
62. London AS, Foote-Ardah CE, Fleishman JA, Shapiro MF. Use of alternative therapists among people in care for HIV in the United States. Am J Public Health. 2003;93(6):980-7.
63. Kitai E, Shlomo V, Sandiuk A, Hornik O, Zeltcer C, Gaver A. Use of complementary and alternative medicine among primary care patients. . Fam Pract. 1998;15(9):411-4.
64. Murray J, Shepherd S. Alternative or additional medicine? An exploratory study in general practice. . Soc Sci Med. 1993;37(8):983-8.

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