

Cosmetic Abuse of Site Enhancement Oils: An Insight Review on Synthol and Other Targeted Enhancement Oils

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Madhana *et al.*: Review on Cosmetic Abuse of Site Enhancement Oils

Enlarged muscle mass is a new trend in today's world. As a result, a variety of approaches to body sculpting have been used. One of them is synthol. A combination of oil, alcohol and lidocaine make up synthol, a site enhancing oil. Site enhancing oils were developed at the turn of the century for use in aesthetic procedures like breast augmentation and wrinkle treatment. Bodybuilders use synthol to increase muscle volume and women use it for breast and buttock enlargement. The effects of enlargement are immediate. Despite the lack of a clear mechanism of action, aficionados continue to use to improve their exterior appearances. Despite its immediate effects, it is seen to be linked to long-term complications such as muscle fibrosis, granulosis, painful nodules, pulmonary embolism, pulmonary artery obstruction, infection issues, and cerebrovascular accident.

Key words: Synthol, site enhancing oils, granulosis, cosmetic enhancement

Competitions are the backbone of high-performance sports and winners are often decided by the smallest of margins, either at the event itself or in the lead-up to it. Many athletes are willing to put their health at risk in order to compete at the highest level^[1,2]. This is done in an effort to increase their chances of victory. It is general knowledge that the history of athletic competition is connected with the practise of purposely placing oneself through dangerous situations or ingesting active natural or synthetic substances whose activities are acute as well as chronic consequences, may be harmful to the user^[3]. This is a behaviour that has been linked to the use of performance-enhancing drugs in the past. Any increase in muscle volume could be considered a competitive advantage in the sport of bodybuilding. The performance of which is determined by the physical appearance of the competitor, which is dominated by the binomial muscular mass *vs.* the body fat content of the competitor. In the world of weightlifting, well-known pharmaceuticals such as anabolic steroids (testosterone and its metabolites) and other hormonal and peptide treatments (insulin and Insulin-like Growth Factor -1 (IGF-1)) are frequently utilised. However, there are circumstances in which these drugs are not adequate to overcome particular physical constraints that are present in an athlete's body. One example of this would be the difficulty of

gaining bulk in a particular muscle. Muscle fillers are chemicals that are injected directly into a muscle to enhance its volume artificially^[4]. In these kinds of situations, some athletes may choose to use muscle fillers. Administration of Site Enhancing Oils (SEO) is also known as muscle-building steroids. It is a well-known illegal practice used in sports like bodybuilding that need great muscular growth. This practice has been associated with negative repercussions on one's health. Decades after the initial injections, the adverse effects of such practices begin to appear, with persistent granulomas being the most harmful^[5]. Synthol is an excellent illustration of an SEO that is widely known. Synthol is an injectable SEO that is normally created out of sesame or walnut oil at 85 %, lidocaine at 7.5 % (a local anaesthetic that is used to prevent pain), and alcohol at 7.5 %. Synthol also contains 7.5 % lidocaine (used as a steriliser). Beginning of the 20th century saw the development of SEO, which were intended for use in cosmetic procedures such as breast enlargement and the removal of wrinkles^[6]. In recent years, both professional and

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amateur bodybuilders have turned to the usage of synthetic steroid compounds to mimic the appearance of trained muscle^[7-9]. Synthol is injected directly into the muscle, which causes the muscle to swell and expand. This method, sometimes known as "fluffing", is frequently used by bodybuilders to enlarge a muscle that they perceive is out of proportion with the rest of the trained body^[7]. It is also possible for athletes of any level of expertise to use it in large quantities in order to grow all of their important muscles, which gives the illusion of a physique that has been built through strength training. The bodybuilding community considers the apparent distinctions between these surgically altered body parts and those attained largely from weight training to be comically clear. For example, unnatural-appearing lumps in the muscles^[10] have been framed as freakish and bizarre by bodybuilders who do not use synthol^[7]. Although there is a lack of scientific evidence for the adverse effects of synthol, there are numerous reports that cite the complications in patients who took injections of paraffin, sesame or walnut oil. These complications include localised problems in skin such as nerve damage and oil-filled cysts, as well as muscle damage^[11,12]. One of the few case studies done on a bodybuilder who took synthol found that the substance was connected with complications such as muscle soreness and muscular fibrosis^[8]. Muscular fibrosis is the disproportionate development of fibrous scar tissue bands between muscle fibres. It has been asserted that synthol use damages the injected muscle and may have significant long-term health implications. This is the case despite the fact that synthol may provide bodybuilders with a technique of addressing perceived inadequacies in particular muscles or their groups. Synthol is easily accessible and seems to be experiencing a surge in demand in the 2000s^[7,10]. Some bodybuilders may find it appealing due to the fact that it would not induce some of the more severe adverse effects that are associated with the use of anabolic steroids^[8]. On the other hand, some bodybuilders may consider the use of synthol to be dangerous and meaningless due to the fact that it does not result in muscle growth that appears to be realistic^[10]. We have a limited understanding of the factors that contribute to long-term use and to the best of our knowledge, no research that have been published have

investigated how users discuss their routines with one another. The intramuscular injectable oil is known as pump and pose. It is the most prevalent form of synthetic cannabinoid that can be purchased on the internet. It has developed into a topic that is considered to be one of the most controversial in modern bodybuilding^[13] and, arguably, elsewhere as well^[14]. Since 1899, when the Austrian surgeon Robert Gersuny injected vaseline into a patient's scrotum to mimic a testicle which he had lost^[6,15,16], the use of materials to patch in morphological or surgical voids as well as body shapes with the goals of reconstruction or cosmetics has been around. This practise has been around for a long time and dates back to ancient times. The heated vaseline, which is in liquid form, transforms into a solid state once its cooled down inside the organism. In later years, paraffin was used instead of vaseline since its melting point was higher, making it a more reliable substance^[15]. Injections of paraffin oil, which were illegal at that time but later, became legalized and fairly common in Italy throughout the 1950s and 1960s^[14]. On the other hand, there have been reports of both short-term and long-term complications, such as paraffin oil migration^[6]. In the body of research available, introcavernosal injection sites for volume enhancement that has been reported the most frequently. In spite of how uncommon it is in the West, it is nevertheless carried out in a number of nations located in Asia and Eastern Europe^[17,18]. Oils such as paraffin oil, cod liver oil, vaseline oil and even oil from an automotive transmission have all been reported as substances injected into the human body, along with olive oil in the same area of injection^[17-21]. When these oils are applied to the introcavernosal site, they can have a number of adverse effects, including but not limited to paraffinoma, deformity, necrosis, impaired erectile function and ulcers^[22,23]. It is known as a paraffinoma and the terminology varies depending on the injected material, being also known as an oleoma or lipogranuloma sclerosis (the latter term is becoming discontinued)^[14]. The tumour that is caused by oils is known as paraffinoma. There are multiple examples of persons self-injecting these and other potentially deadly drugs into their bodies and these examples may be found in various pieces of published literature. There have been reports of people applying Baby Johnson oil or commercial paraffin

oil on their cheeks, lips, and chin, which resulted in a paraffinoma^[16]. A paraffinoma is the complete removal of the whole tissue that carries the vital toxin. Benedetto *et al.*^[6] report 26 cases of patients experiencing numerous complications due to illegal injections of paraffin oil. These injections were administered into the breasts of women for cosmetic purposes and into the knees or elbows of men to avoid obligatory military service in Italy. The primary effects were swelling, redness, skin rigidity and rupture, extrusion of greasy material from the pectoralis and joints, difficulty flexing or extending the limbs. Regular use of these aids is common among transsexuals in the pursuit of achieving a more feminine appearance^[24,25]. In a similar fashion, bodybuilders make use of oil injections to artificially expand the volume of their muscles, this practise is becoming increasingly common among members of health clubs^[26]. The use of local applications in bodybuilding dates back to the 1960s, when a product that is now known as Esiclone (formebolona) first began to be made in Italy for medicinal purposes. At that time, Italy was the only country that produced Esiclone. In the 1980s, when the previous century was still young, it was already common practise for bodybuilders in both Europe and the United States of America to use it. Before a competition, bodybuilders would inject themselves with Esiclone in order to increase the volume of a particular muscle region. It has been determined that a steroid with modest anabolic activity and pro-inflammatory properties is to blame for the seemingly sudden increase^[27,28]. The production of it was stopped not long after the advent of synthol, which was a synthetic anabolic steroid that was developed in the 1990s by a bodybuilder. Synthol is made up of 85 % intermediate oils, 7.5 % analgesic lidocaine and 7.5 % alcohol. All of these ingredients are in equal proportions. It is administered intramuscularly and once it takes effect, it functions similarly to a temporary implant. Nerve damage and pulmonary embolism are two documented side effects of synthol^[29]. Other possible adverse reactions include pulmonary artery blockage, myocardial infarction, infection-related issues and cerebral vascular accident. However, anecdotal evidence suggests that it began around the end of the 1980s and the beginning of the 1990s, particularly among competitive bodybuilders who seek cosmetic

development of muscles that do not respond to training. It is impossible to say when the use of liposoluble vitamins A, D, and E (ADE) in began in Brazil. However, anecdotal evidence suggests that it began around that time. The first recorded occurrence of this phenomenon in Brazilian scientific literature dates back to the late 1980s^[30]. Bodybuilders of the day utilised moderate amounts of resistance training in an effort to bring the volume of their calves into proportion with the volume of their other muscles. They ultimately started using ADE in the biceps and triceps, but they only used it in modest doses, just enough to dramatically boost the volume of the arms and equalise it with the volume of the other muscular parts. Bodybuilders who used ADE tried not to overstate their gains, as judges prioritize symmetry and proportionality between muscles, along with muscle size, separation and definition^[31]. Because the increase in muscular size is not the result of muscle hypertrophy, the use of ADE in Brazil and synthol in the United States of America is looked down upon even among steroid users. This is because the use of such chemicals is seen as more of a form of cheating than the use of hormonal agents and this is due to the fact that the muscular increase is not the product of muscle hypertrophy. In the 1990s, the use of ADE would have experienced substantial and constant growth. However, it appears that the use of ADE has become a public health issue in recent years. This is due to the fact that novice bodybuilders have begun using ADE as their primary option for locally enhancing muscle tissue and lay media reports of problems associated with this use have been rising^[32]. Synthol is basically an admixture composed of an intermediate-chained neutral oil such as sesame oil, which comprises 85 % (contains linoleic acid (41 % of total), oleic acid (39 %), palmitic acid (8 %), stearic acid (5 %) and others in tiny amounts), a filler steriliser such as an alcohol (benzyl alcohol) and a local anaesthetic such as lidocaine. Fig. 1-fig. 3 illustrates the molecular structures of one of the components of the mixture, namely sesame oil, lidocaine, or benzyl alcohol^[33-35]. No human investigations have scientifically and decisively demonstrated the mechanism of action by which intramuscularly injected oils increase volume and the reason of the morphological pattern that occurs in those targeted muscles^[4]. This is because there have been no

studies that have been conducted on humans that have been able to prove experimentally and conclusively the mechanism of action. On the other hand, the prevalent school of thought maintains that the oil (foreign substance) is encased in a fibrosis-like response. This is thought to be analogous to that occurs in the animal subject when body fat is injected into its muscles^[36]. The following describes the clinical development of the injection of mineral oil A is the phase of beginning inflammation, B is the phase of latency, and C is the phase of chronic and advanced disease. After the initial injections have been given, the patient may continue to experience an inflammatory phase for several months. Larger volumes cause an immediate inflammatory response^[6] and/or an allergic reaction^[37], and the degree of inflammation that results is proportional to the volume that is injected. During the latency period, the substance that was injected into the muscle may remain unchanged there for a number of months, years or even decades. The latency phase may vary depending on whether mineral or vegetable oil was administered. In some cases, the collateral effect of mineral oils did not become apparent until more than two decades after the injections^[24,17]. Chronic reaction happens when the immune system of the host tries to eradicate the foreign substance by material fragmentation *via* macrophage action^[12,6], which may result in the formation of paraffinoma^[38,19]. This process causes the chronic reaction. Mineral oils are resistant to lysosomal enzymes and cause chronic granulomatous inflammation^[39]. It is unclear whether these enzymes are responsible for the oxidation of the vegetable oils found in ADE. Granulomatous disease has been associated with other types of vegetable oils, but there have been no reports of it occurring in people who use ADE up to this point^[4]. After subcutaneous oil treatment, fatty acids can induce calcification and hyaline sclerosis in adipose tissue^[6,39]. However, calcification can also take place after oil is applied intramuscularly^[12]. After responding to the oil injection, the injected oil may be surrounded by gigantic multinucleated cells. This might occur either at the beginning or the end of the oil injection response. Fibroblasts are responsible for the creation of collagen fibres^[6] that leads to the development of fibrous tissue. This engulfs the oil and divides it into minute globules, resulting in skin that is stiffer, necroses

and nodules^[12]. The injected oil will be contained by the inflammatory and fibrotic processes, in addition to the lipophilic barrier that the muscle fascia provides. There is a school of thought that holds that vegetable oil is more prone to encapsulation than mineral oils^[12]. The nodules might be very large and easily obvious or they can be extremely little and fragmented, rendering them invisible to the naked eye. When palpated, either form may be painful for the patient. It may be necessary to undertake surgery in order to remove the oil and/or the affected area^[12,6]. On the other hand, surgery might not be an option in situations where a significant portion of the body is afflicted^[39]. In the case that an inadvertent intravenous infusion takes place, oil may enter the lungs, causing embolism and alveolar haemorrhage^[21,40], a condition that is comparable to fat embolism^[25]. Even if an intramuscular injection is encapsulated, fat deposits could still be a target of mobilisation, which would result in the gradual release of small amounts of oil and could potentially cause an embolism^[30]. Intramuscular injections of sesame oil were given to dogs, rabbits and rats over the course of several weeks and months^[41]. The injection of oil resulted in pulmonary microembolism as well as bigger lymphatic nodules that contained sesame oil. This finding suggests that even little amounts of oil ejected from lymph nodules could be detrimental. Unlike silicone^[4], vaseline and paraffin, vegetable oils are not a non-reactive substance. It is not apparent whether this has an effect on muscle tissue that is less detrimental than the effect of mineral oils. There have been several cases of oil injection reported in the Brazilian media and some people have died as a result of self-injecting vegetable oils, including ADE and even cooking oil, in Brazil. Some of the fatalities were caused by ADE and there have been reports of coma, necrosis of the muscles, and multiple deaths in some of the instances^[32]. In conclusion, it may be claimed that bodybuilding is a sport in which performance is determined by physical appearance and is governed by the balance between muscle mass and body fat percentage. This is the case since the sport is determined by physical appearance. Because of this, every increase in total muscle mass is regarded as a potential source of competitive advantage. In order to improve the appearance of muscles, weight lifters frequently

use well-known drugs such as various oils and fillers, anabolic steroids, and other hormonal and peptide medications, including insulin and IGF-1. These treatments can be found in a broad variety of combinations. Synthol is a type of SEO that is commonly used. It is produced by combining neutral oil (typically walnut or sesame, which accounts for 85 % of the total volume), lidocaine (which functions as a local anaesthetic and occupies 7.5 % of the total volume) and alcohol (which functions as a steriliser and accounts for the remaining 7.5 %). It is injected directly into the muscle that is the focus of the treatment, which causes the muscle to grow and enlarge. Users were commonly drawn to synthol because there was

little credible medical evidence indicating any adverse effects. However, while the use of synthol by bodybuilders provides them with the desired short-term effect, in the long run, the compound gradually damages the target muscle. Users run the risk of developing major side effects throughout the course of their use. These include but are not limited to stroke, damage to nearby nerves, pulmonary embolism, localized skin problems, oil-filled cysts, and damage to muscles. When considering the short-term and long-term applications of SEO by bodybuilders, it is reasonable to argue that a great deal more clinical research is required.

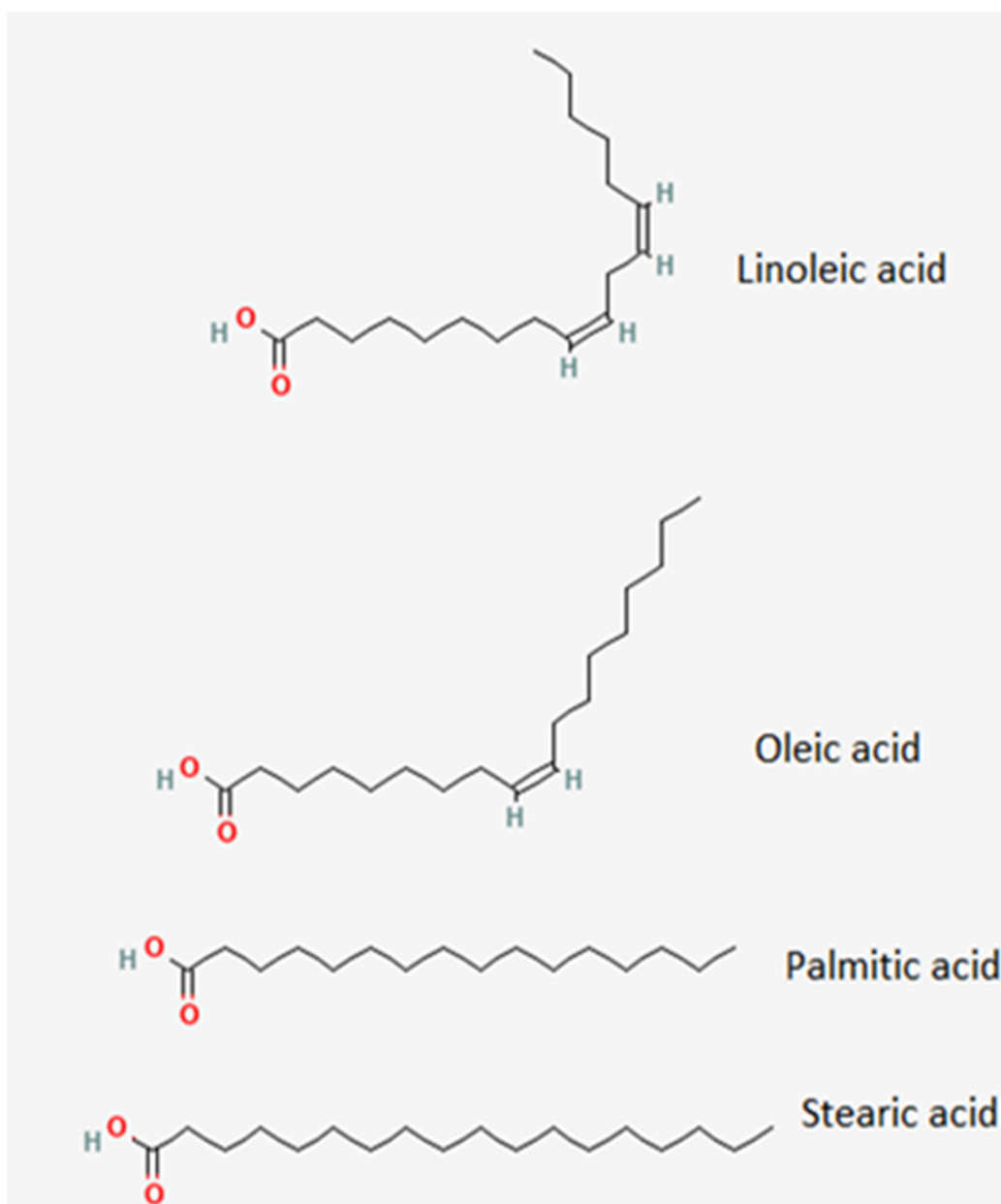


Fig. 1: Structural composition of sesame oil containing various chains of fatty acids^[33]

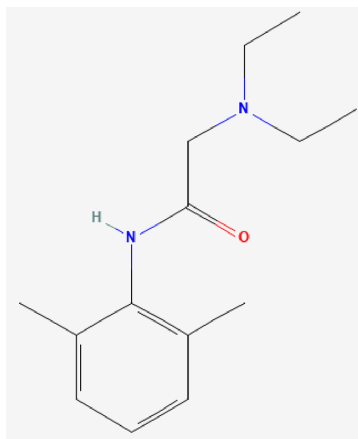


Fig. 2: Structure of lidocaine^[34]

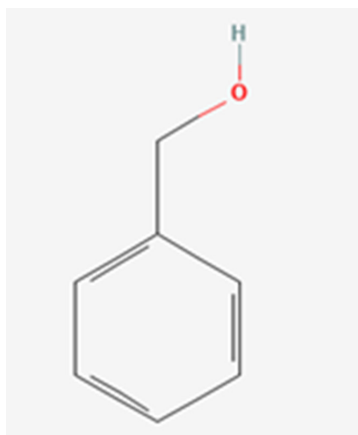


Fig. 3: Structure of benzyl alcohol^[35]

Conflict of interests:

The authors declared no conflict of interests.

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