ISSN PRINT 2319 1775 Online 2320 7876

Research paper UGC CARE Listed (Group -I) Journal Volume 11, Iss 12, 2022

ELECTROMYOGRAPHY AND THE STUDY OF YOGIC MOVEMENTS: A REVIEW

[1]Mr. Ratan Kumar Deshi, [2]Dr.AninditaDas, [3]Mr. Yuvraj Singh Chauhan, [4]Ms. Masuda khatun

[1]Ph.D. Scholar, Department of Sports Biomechanics, LNIPE, Gwalior, E-mail: ratankumardeshi05@gmail.com, ORCID ID: 0009-0009-4437-5326

[2]Associate Professor, HOD (Physical Education Pedagogy), LNIPE, Gwalior (M.P) E-mail: anindita416@gmail.com, ORCID ID: 0000-0002-6502-9619

[3]Ph.D. Scholar, Department of health education LNIPE, Gwalior, E-mail: yuvrajschauhan90@gmail.com

[4]Ph.D. Scholar, Department of Physical Education Pedagogy LNIPE, Gwalior, E-mail: masudak76@gmail.com

Corresponding Author: Ratan Kumar Deshi (ratankumardeshi05@gmail.com)

Abstract

Yoga is a comprehensive spiritual instrument that has many advantages, including bettering health and wellbeing. Asanas (physical postures), pranayama (controlled breathing), and meditation are yoga practices that are frequently used for their health benefits. Yoga may be mistakenly thought of as another form of physical exercise because, when viewed in the context of asanas, it mimics physical exercise more closely. The link between the study of yogic movements and electromyography (EMG) is thoroughly reviewed in this research. Yoga involves a variety of physical postures (asanas) and breathing techniques (pranayama), both of which have been proven to offer several health advantages. Our knowledge of the physiological impacts of yogic movements has greatly benefited from the use of EMG, which monitors muscle activation. It is impossible to draw any conclusions from a survey of the EMG research on several complicated yogic talents, including methodological techniques. We made an effort to establish guidelines for the EMG approach at the outset of this review. An exhaustive examination of the subject of electromyography and yoga is impossible due to the fact that information is dispersed across a wide range of journals, including those devoted to sports sciences, ergonomics, biomechanics, applied physiology, various congress proceedings, and so forth. As a result, numerous crucial elements and perhaps crucial articles may have been missed from our review.

Keywords: EMG, Yogasana, Muscle Activation, Surface Electromyography, Kinesiology, Biomechanics.

ISSN PRINT 2319 1775 Online 2320 7876

 UGC CARE Listed (Group -I) Journal Volume 11, Iss 12, 2022

Introduction:

Yoga is compared to many movement-based disciplines, particularly physical fitness routines, as it becomes more and more popular among people from all walks of life. Yoga is a special kind of exercise that integrates the mind, body, and spirit to enhance fitness and wellness (Deshi & Das, 2023a, 2023b; Deshi & Mishra, 2023; Kumar Deshi & Bajpai Mishra, 2023).One occasionally equates yoga with exercises due to the apparent resemblance of the exterior movements. (Govindaraj et al., 2016). Weddell et al. originally used the term electromyography (EMG) in 1943 and were the first to employ needle electrodes to examine muscles in a therapeutic setting. Since that time, doctors have referred to the electrophysiological testing of peripheral nerve and muscle—which includes needle EMG and nerve conduction studies (NCS)—as EMG or Clinical EMG. Unfortunately, this still causes misunderstanding among doctors and healthcare professionals. Some doctors refer to the study as EMG/NCS, reserving the label EMG exclusively for the needle EMG evaluation and adding the term NCS to indicate both studies independently. Some have continued to refer to the full evaluation as an EMG while referring to the muscle evaluation with a needle as a needle electrode examination (NEE). The electrodiagnostic (EDX) examination, a general term that includes both the needle EMG and NCS, has grown in popularity more lately. The terms electrophysiologic examination (which is sometimes confused with cardiac electrophysiological tests) and electroneuromyography (ENMG) examination (which, in my opinion, provides the most correct, albeit uncommon, description of the investigation) are also used internationally. The term electromyographer (EMGer), electro diagnostician, or EDX specialist is used to describe the medical professional who conducts and interprets these examinations (Katirji, 2002). If electromyography (EMG) is used properly and the accompanying constraints are understood, it can be a highly useful tool in ergonomic studies. The application of EMG requires knowledge in physiology, instrumentation, recording technology, signal processing, and analysis, among other fields. In order to understand how these regions interact and affect the efficient use of EMG, this paper presents a general overview of these domains (Marras, 2000a). EMG, often known as electromyography, is a useful research and diagnostic method for analyzing the electrical activity of muscles. The electrical impulses generated by muscular contractions are measured and recorded. Numerous disciplines, including clinical medicine, sports science, rehabilitation, and biomechanics, use EMG extensively. The foundations, methods, clinical applications, and new trends in electromyography will all be covered in this overview study.

Fundamentals of EMG:

Muscle Activity:

When muscles contract, they produce electrical signals called action potentials. In order to get knowledge about how muscles operate, EMG records these signals. An investigation of the electrical activity of skeletal muscles is done using the neurophysiological technique known as electromyography (EMG). The muscle membrane potential serves as the EMG's electrical signal's source. A motor unit (MU) is made up of the muscle fibers that are innervated by a motor neuron's axonal branches. Each motor unit has muscle fibers that are intertwined with fibers from other Mus (Enoka, 1995). Motor unit action potential (MUAP) is the accumulation of MUs' action potentials (Buchthal, 1985). The anatomical and physiological characteristics of the motor system are reflected in the bio signal obtained from a muscle or its fibers. Therefore, EMG recording and analysis are potent neurophysiological techniques that can be used to: a) identify the health status of the motor system; b) localize and typify peripheral and central abnormalities and lesions; c) determine the temporal course and the severity of motor system abnormalities; and d) determine and evaluate the efficacy of treatment approaches. Muscle activity can be found both while a person is at rest and when they are moving voluntarily. Additionally, peripheral nerve stimulation (PNS) and cortical stimulation can be used to induce compound action potentials (CMAP) and motor evoked potentials (MEP), respectively. While PNS allows for the testing of the peripheral motor system's integrity, cortical stimulation methods like Transcranial Magnetic Stimulation (TMS) enable the examination of the corticospinal tract's integrity. Additionally, since the late 1970s, the efficacy of EMG recording as a technique for intraoperative neuromonitoring has been discussed (Delgado et al., 1979). As of now, EMG recording is a practical method for avoiding neurological harm during a variety of surgical operations (Wu et al., 2013).

Electrodes:

To record EMG signals, surface electrodes or needle electrodes are frequently employed. While needle electrodes are injected directly into the muscle for more exact measurements, surface electrodes are non-invasive and implanted on the skin's surface.

Needle EMG (n EMG):

With nEMG, deep muscles can be locally recorded by inserting a needle electrode into the muscle tissue. Anatomical landmarks that can be verified by a proper contraction of the chosen muscle are used to pinpoint the needle insertion spot. Individual MUs can be evaluated using nEMG, which also records high-frequency signals more accurately and sensitively, such as various assessments of spontaneous activity (Merletti & Farina, 2009; Wu et al., 2013).

However, nEMG has a number of drawbacks. First, because of its small detection volume, it only represents the activity of a small subset of active MUs with fibers that are in close proximity to the location of the detection site. For the analysis of MUAPs to have acceptable power (sensitivity and specificity), a sufficient sample is required. Additionally, it is challenging to explore tiny muscles using a conventional sample size (Podnar & Mrkai?, 2003). Second, it is impossible to record nEMG for an extended period of time since it hurts, especially when muscles are active. Rarely, local damage (like pneumothorax) could happen while inspecting certain fragile areas (Reinstein et al., 1987). Additionally, nEMG is temperature- and time-sensitive. In this regard, the observed signal in nEMG may change depending on how long has passed since the nerve injury started (Quan & Bird, 1999). Low temperatures at the examination location change the parameters and properties of the recorded signals because they have a significant impact on neuromuscular transmission and action potential propagation along muscle fibers (Rutkove, 2001).

ISSN PRINT 2319 1775 Online 2320 7876
Research paper© 2012 IJFANS. All Rights Reserved, **UGC CARE Listed (Group -I) Journal Volume 11, Iss 12, 2022**

Surface EMG (sEMG):

Surface electrode myography, or sEMG, is a method for non-invasively measuring muscle activity using electrodes inserted on the skin just above the muscle. First off, sEMG recording is painless, especially when done without applying any external stimulation to the peripheral nerves. Additionally, sEMG electrodes record from a large portion of the muscle territory, giving a more comprehensive view of MUs. Last but not least, it enables lengthy simultaneous recordings of muscle activity from several locations. However, sEMG has a limited signal resolution and is quite prone to artifacts due to movement (Pullman et al., 2000) , include body heat. Additionally, since deeper MU contributions are not evaluated, superficial MU contributions dominate sEMG signals; hence, situations that increase skin resistance (such as obesity and edema) disrupt the sEMG signal (Wu et al., 2013).

Methodologies in EMG:

The recording system:

The recording system can be thought of as a set of instruments for capturing, amplifying, filtering, and ultimately storing the myoelectric signals. As a result, it can be split into systems for signal detection and signal amplification.

Signal detection:

EMG electrodes are carefully positioned on the skin or injected into muscles to detect electrical impulses. While needle EMG is used for more precise evaluations of muscle health, surface EMG is frequently employed for clinical and athletic applications.

The simplest piece of knowledge that can be gleaned from an EMG signal is whether the muscle of interest was used during an exercise. This kind of information can be determined with little to no signal processing. The only requirement for the experimenter is that the signal be devoid of crosstalk, noise, and artifacts. The muscle was being used during the effort whether the unprocessed or processed signal showed activity. Most of the time, it is important to merely note whether a muscle was active or to record how long it was active during a specific workout. The EMG signal can be processed by either hardware or software, depending on the desired type of quantification, if the muscular force is of interest. The muscle's level of activity can be recorded first. It is common practice to normalize this factor's representation. However, other scholars define this amount in absolute terms (as muscle activity measured in microvolts). Simply put, this measurement reflects how active the muscle was during the experimental circumstances. The measurement is merely a reflection of how much muscle is being used, not a reflection of muscular force. The signal can be assessed in a number of ways, including peak activity, mean activity, activity in relation to a specific position or posture, and rate of muscle activity start. The amount of muscle force used during an exertion can also be determined using the processed EMG data. The signal can be handled in absolute or relative terms, similar to how muscle activity is. To obtain more quantitative data on the muscle, the EMG signal must be used in conjunction with other forms of calibrations if muscular force is of interest (Marras, 2000b).

ISSN PRINT 2319 1775 Online 2320 7876

Research paper© 2012 IJFANS. All Rights Reserved, UGC CARE Listed (Group -I) Journal Volume 11, Iss 12, 2022

Signal amplification:

Amplifier specs have been developed as a result of modern technology to solve measurement issues. The experiment and the electrodes used will determine how much amplification is needed. Individual spike potentials will be added together to yield peak voltages of about 1-2 mV using surface EMG.(Basmajian, 1985; Clarys & Cabri, 1993a; McLeod, 1973). The required amplifier gain depends on the system's signal-to-noise ratios(Clarys & Cabri, 1993a; McLeod, 1973). It is advisable to employ as much amplifier gain as the remainder of the myoelectric data retrieval system can handle in order to maximize this relationship.

Signal characteristics:

The control mechanism of the central nervous system, the anatomical and physiological characteristics of the muscles, as well as the features of the instrumentation used to detect and observe them, all have an impact on the extremely complex signal known as the EMG. (Clarys & Cabri, 1993a; De Luca, 1979). A complicated interference pattern that results from the accumulation of asynchronously firing motor units in the active muscle can be used to describe it (Clarys & Cabri, 1993a; Petrofsky & Lind, 1980). and has a somewhat low selectivity when produced with surface electrodes (Bouisset, 1973; Clarys & Cabri, 1993a) Similar to how the electrical activity of a muscle is a weighted sum in both place and time of numerous individual events, the electrical activity of a muscle is a collection of individual electrical events in the muscle (Clarys & Cabri, 1993a; Hogan & Mann, 1980). Due to this difficulty in quantifying the raw signal, the most popular method for analyzing muscle activity at this time is a qualitative (visual) approach (Clarys & Cabri, 1993a).

According to reports (and experiments that corroborate them), the EMG recorded with surface electrodes has an essentially Gaussian amplitude distribution with a zero mean. (Clarys & Cabri, 1993a; Kadefors et al., 1983; Sherif & Gregor, 1986). The root-mean-square (rms) value of the signal correlates to the standard deviation, which has a microvolt size. Sometimes the EMG signal is not stationary, particularly during intense voluntary movements where there may be quick variations in muscle force. However, the signal is presumed to be stationary during the measurement period because it does not appreciably alter its statistical characteristics over the analysis period.(Kadefors et al., 1973) When compared to the frequency components of the EMG signal, the frequency components of muscle force are nearly an order of magnitude lower (Hogan & Mann, 1980). Consideration of EMG as a time-dependent periodic signal made up of repeats of the same standard waveform and having amplitude, frequency, and phase characteristics is another (restrictive) approach to look at it (Clarys & Cabri, 1993a). Positive and negative values are provided by oscillations in the signal around the baseline. The frequency of this oscillation changes with time and is certain. Another way to represent the periodic waveform is as the sum of simple sines and cosines, whose frequencies are integral multiples of the original fundamental frequency (the frequency at which the signal repeats itself). In comparison to needle or wire electrodes, Table 1 lists the usual amplitude and frequency ranges of the EMG signal as measured by surface electrodes. The raw surface EMG signal has a frequency range of 0.1–3000 Hz and an amplitude range of 0.05–5 mV, while some writers have only detected frequencies up to 1000 Hz, as was already mentioned (Kadefors et al., 1973; Kadefors & Petersén, 1970) Indeed, it was written that "the majority of investigators agree that the energy above 250 Hz is negligible when monitoring gross myoelectric signals." M. rectus femoris contractions at their maximum voluntary contraction, (Viitasalo & Komi, 1975) observed significant reliability and consistency correlations in daily experiments in the frequency range of 24-800 Hz.

Table 1. Amplitude and frequency range of EMG Signals (Clarys & Cabri, 1993a)

Signal	**Amplitude range (mv)**	**Signal frequency range (Hz)**	**Electrode type**
Indwelling EMG	0.05-5	0.1-10 000	Needle/Wire
Surface EMG	0.01-5	1.0-3 000	Surface
Nerve potentials	0.005-5	0.1-10 000	Needle/Wire

Researchers have put a lot of work into trying to quantify the surface EMG because the raw EMG signal, because to its complexity, is only appropriate for visual qualitative interpretation. No matter how advanced the processing techniques used, the appearance of artifacts is undesirable and may completely invalidate the output. As a result, it's still crucial to monitor the raw EMG before you analyze it. Additionally, it can provide intriguing details regarding the phasic relationships between different muscles, such as distinguishing the states of muscles that are "on" or "active" and "off" or "inactive" during a movement (Clarys & Cabri, 1993b). To enable researchers to compare findings not only within their own laboratories but also between laboratories, the EMG signal must be quantified. Therefore, the 'amount of activity' is a crucial metric in EMG processing and can be attained in various ways. Additionally, the advent of computer technology has been warmly embraced because it has relieved kinesiologists of the strenuous effort required when using planimetry. However, it has also led to additional misunderstanding regarding nomenclature, norms of technique and processing, and other issues, making it challenging to compare studies frequently.(Clarys & Cabri, 1993b).

EMG parameters:

Analyzing physical signals, mathematical functions, or time series of economic or environmental data are all examples of time-domain parametric analysis of EMG signals. The following EMG parameters were collected for analysis: Muscle force and non-fatigue contraction are described by the RMS feature, signal power is best quantified by the VAR feature, WA denotes the firing of the motor unit potential, and ZC gives details on the frequency of the EMG signal. The Simple Square Integral (SSI) calculates the sum of the squares of the EMG signal amplitude (Suma et al., 2022). Equations are used to compute these parameters.

ISSN PRINT 2319 1775 Online 2320 7876

 UGC CARE Listed (Group -I) Journal Volume 11, Iss 12, 2022

Root Mean Square (RMS):

$$\mathbf{RMS} = \left(\frac{1}{N}\sum_{n=1}^{N} y_n^2\right)^{1/2}$$

where Yn stands for the wavelet coefficient and N for the wavelet's length.

Zero Crossing (ZC):

$$\mathbf{ZC} = \sum_{n=1}^{N-1} f(Yn)$$

$f\ (Yn) = 1,\ if\ \{(Yn > 0\ \&\ Yn{+}1 < 0)\ |\ (Yn < 0\ \&\ Yn{+}1 > 0)\}\ \&\ |Yn - Yn{+}1\ | \geq T\ f\ (Yn) = 0,$ $otherwise$ where threshold is represented by T, wavelet coefficient by Yn and its length by N

Willison Amplitude (WA):

$$\mathbf{WA} = \sum_{n=1}^{N-1} f(Yn)$$

$f\ (Yn) = 1,\ if\ |Yn - Yn{+}1\ | \geq T\ f\ (Yn) = 0,\ otherwise$ where threshold is represented by T, wavelet coefficient by Yn and its length by N

Simple Square Integral (SSI):

$$\mathbf{SSI} = \sum_{n=1}^{N} Y_n^2$$

where wavelet coefficient is represented by Yn and its length by N

EMG signal Variance (VAR):

$$\mathbf{VAR} = \frac{1}{N-1}\sum_{n-1}^{N} Y_n^2$$

where wavelet coefficient is represented by Yn and its length by N (Suma et al., 2022).

Rectification:

A linear full-wave rectifier, which reverses the sign of all negative voltages and produces the absolute value of the EMG, serves as the foundation for the majority of quantification. Additionally, non-linear rectifiers may be utilized (for example, a square law detector for the EMG's root-mean-square values). It can be done either by inverting the negative values (full-wave rectification), which is preferred since it preserves all of the signal's energy, or by deleting the negative values (half-wave rectification). (Clarys & Cabri, 1993b). Analog-to-digital converters are employed instead of "black boxes" (in many studies, details of the filtering properties, such as time constant and frequency response, are frequently not provided), and the information, whether raw or rectified EMG, is recorded on disk. The linear envelope (LE), which is the end product of the signal-processing approach, requires the signal rectification as an essential step. The average of the rectified EMG signal is expressed mathematically as (Clarys & Cabri, 1993b).

$$\textbf{average rectified EMG} = \frac{1}{t_{2-t_1}}\int_{t1}^{t2} |EMG|dt$$

The phrases "average," "mean," and "ensemble average" seem to be a source of considerable misunderstanding, and the formulae suggested occasionally depart from their true statistical definitions. The following equation actually entails rectifying the EMG signal, "integrating" (i.e., summing) the rectified signal, and dividing the outcomes by the integration's time period.(Clarys & Cabri, 1993b).

It should be noted that as the period of time used to calculate the average gets shorter, the signal's smoothing gets shorter as well. A time window may be defined to obtain a time-

ISSN PRINT 2319 1775 Online 2320 7876

 UGC CARE Listed (Group -I) Journal Volume 11, Iss 12, 2022

varying average of the signal, an operation known as the moving average. (Clarys & Cabri, 1993b).

window average = $\frac{t}{T}\int_{t}^{t+T} |EMG|dt$

This approach merely involves calculating the average corrected EMG over a fixed amount of time that is shifted continuously in time. Because the signal gets less smooth and more similar to the raw signal as the time constant declines, care must be made to set it at a "reasonable" value

Ensemble average:

It is frequently crucial to obtain the average pattern of EMG activity in any repeating movement or triggered response. Digitally, an ensemble average can be achieved in a general-purpose computer or a C.A.T. (computer for average transients). It is frequently possible to average the resulting compound action potentials using evoked stimuli. The amplitude of the time averaged wave shape is in Mv, and it's crucial to note how many averages there are. The standard error at each time point may also be significant. At each time t, the expression for N time averaged waveforms is:

EMG (t) = $\frac{1}{N}\sum_{i=1}^{N} |EMGi|\ (t)\ mV$

Where EMGi is the ith repetition of the EMG waveform to be averaged (Kadefors et al., 1980).

Recording Techniques:

There are two different electrode types. Except when a tine wire method is specifically warranted, surface EMG techniques are significantly more prevalent. The activity of the muscles or muscle groups that the electrodes are placed over will often be represented by surface EMG. The main focus is probably on the larger muscles or in muscular groups, despite the fact that surface EMG is more difficult to record from deep or smaller muscles. The EMG can be recorded using the right techniques in this situation, It is important to take into account the required immobilization procedure as well as the methods, benefits, and restrictions involved with the employment of these techniques. It also requires controls to ensure a high-quality feed. If there are preamplifiers, they first amplify the signal before it is further boosted by the main amplifiers. The signal is filtered at this stage and may also be conditioned or manipulated. Processing a signal could entail rectifying, averaging, integrating, creating a linear envelop, or applying root-mean-square analysis. Only the raw signal itself may be recorded and decoded. However, most EMG data are often processed in some way. It is advised to use FM or digital tape for recording, or an analog-to-digital (A-D) converter on a computer. Computer-based spectrum analysis must be carried out if they are of interest. (Marras, 2000a).

Normalization of the EMG:

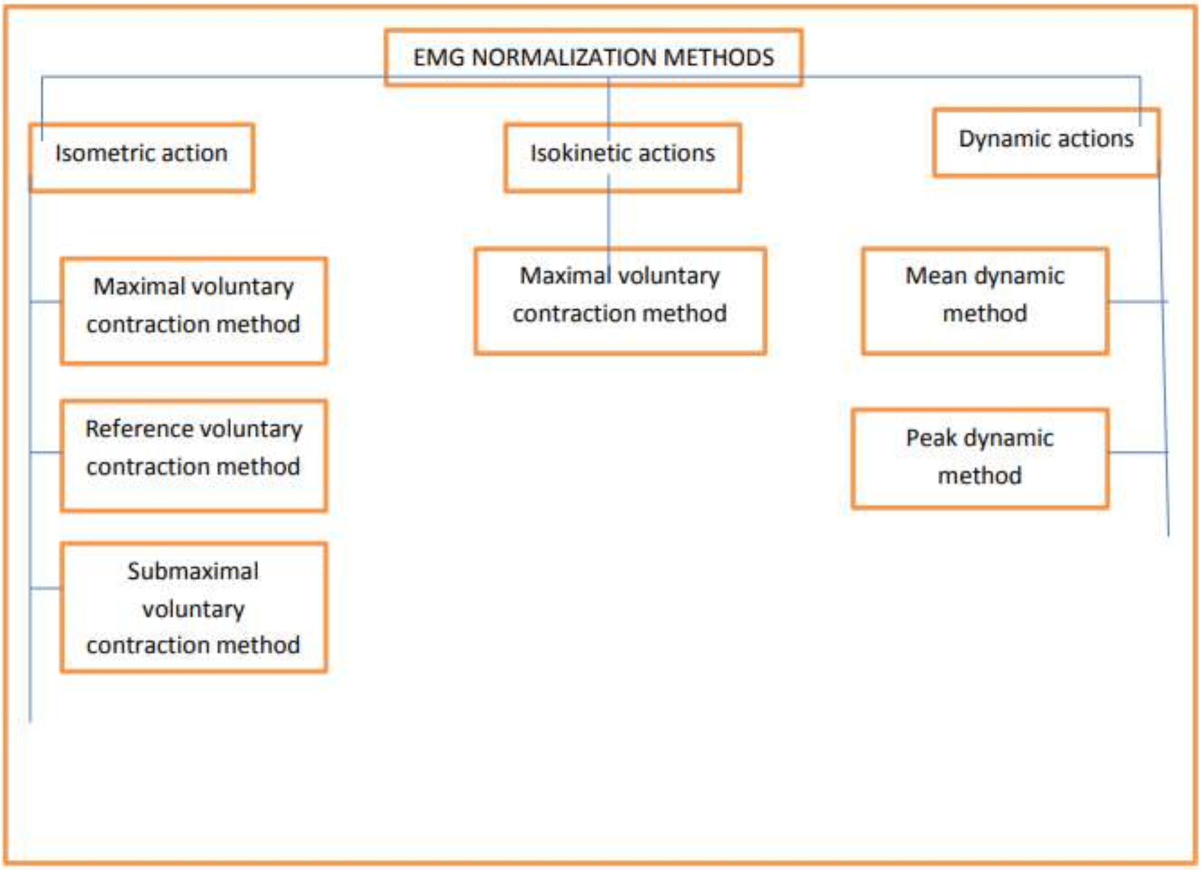
As was previously indicated, the clinical interpretation of surface EMG necessitates the normalization of the EMG signal for physiological interpretation and for comparison between muscles and between persons due to the intrinsic variability of the EMG signal. Isometric,

ISSN PRINT 2319 1775 Online 2320 7876

Research paper© 2012 IJFANS. All Rights Reserved, UGC CARE Listed (Group -I) Journal Volume 11, Iss 12, 2022

isokinetic, and dynamic muscle activity have all been employed in previous studies to generate

Figure: 1 **Usual electromyographic normalization methods.**



reference EMG readings for normalization reasons that may be repeated across subjects and test days (Burden et al., 2003; Lehman & McGill, 1999; Sousa & Tavares, 2012; Yang & Winter, 1984).

Due to the known unpredictability of the EMG signal, which exists not only across people but also between different trials, many normalizing approaches have been developed to lessen this variability (Clarys & Cabri, 1993b; Yang & Winter, 1984). Typically, the highest EMG value or the EMG representing the utmost effort has been chosen as the normalization factor (Clarys & Cabri, 1993b; Perry & Bekey, 1981). Typically, the participant is instructed to exert their full voluntary power in the studied muscle (or groups of muscles). This amplitude is then used as a reference value (such as 100%) for all subsequent dynamic actions, whether it is raw or corrected (Clarys & Cabri, 1993b; Clarys & Olbrecht, 1983; Yang & Winter, 1984). The debate around this normalization method has recently come up again since some researchers discovered dynamic activities that went beyond the maximum isometric effort. As a result, various normalization methods for kinesiological EMG have been devised, such as normalization to the dynamic condition with the highest peak activity, to mean integrated EMG (ensemble average), to EMG per unit of measured force (net moment), and so forth.

ISSN PRINT 2319 1775 Online 2320 7876

Research paper© 2012 IJFANS. All Rights Reserved, UGC CARE Listed (Group -I) Journal Volume 11, Iss 12, 2022

Electromyography studies in Yogasana: A critical appraisal of EMG studies

The majority of sports activities require complex movement patterns that are frequently made more difficult by outside forces, impacts, and the sports equipment being used at the time. The dynamic participation of particular muscles within a predetermined range of a sports movement pattern is expressed by an electromyogram (or its derivatives). The muscle intensity of such pattern is expressed by its integrated EMG. However, force and intensity are not necessarily connected. The reader is directed to for a review of EMG and force in relation to voluntary effort and isometric circumstances (Cabri, 1991; Clarys & Cabri, 1993a).

This essay's major goal is to examine EMG and yoga asana motions. Table 2 contains specific yoga EMG studies by author(s), skills, and muscles tested, along with details on the kind of electrodes and registration modes utilized. This evaluation of the EMG yoga literature does not pretend to be thorough. A critical evaluation of muscle selection, electrode placements, and registration techniques will be possible with the help of this information.

Table 2: Review of EMG-sport and registration information in the literature .

Author's	Yogasana	Muscles	Electrode	Registration
(Mullerpatan Et Al., 2020)	The 12-Pose Sequence Of Surya Namaskar	Lower Trapezius, Latissimus Dorsi, Erector Spinae, Rectus Abdominis, Gluteus Maximus, Vastus Lateralis, And Gastrocnemius,	Eight-Channel Surface Electromyography (Semg)	Wireless, Eight-Channel Surface Electromyography (Semg) System At A Sampling Rate Of 2000 Hz And Bandwidth Of 20–450 Hz. Data Were Processed Using Emgworks Analysis Software, And Root Mean Square Values Were Normalized Against Muscle Activity During Maximal Voluntary Contraction (MVC).
(Devaraju Et Al., 2019)	Trikonasana	Ternocleidomastoid (SCM), Abdominal Oblique, Latissimus Dorsi, Quadriceps Femoris, And Medial Hamstring	Delsys EMG Trigno™ Wireless Systems Equipment(Semg)	DelsysEMG Trigno™ Wireless Systems EquipmentWasUsed ForTheDataCollectionWithSmart SensorsConnected To A PC Running Emgworks® 4.3.2 Software (DELSYS).

ISSN PRINT 2319 1775 Online 2320 7876

 UGC CARE Listed (Group -I) Journal Volume 11, Iss 12, 2022

(Kumar Et Al., 2018)	Trikonasana	Right External Oblique Muscle,	Wireless Semg Sensor	The Surface EMG Techniques Can Be Used In The Current Study To Validate The Results Acquired From The Lifemod Simulations. For The Data Acquisition, We Used The Trigno™ Wireless Semg Sensor, Courtesy Of Delsys Inc.
(Trakroo Et Al., 2013)	Talasana, Utkatasana, Trikonasana, Ardha-Matsyendrasana , Bakasana, Pavanamuktasana, Navasana, Noukasana, Matsyasana, Pashchimottanasana, Halasana, Bhujangasana, Shalabhasana, Sarvangasana And Shavasana	Frontalis Muscle Of The Forehead And Biceps Of The Dominant Hand Were Studied.	Surface Emg	The Maximum Amplitude Of The Raw Emg Was Determined. Mean Values Of The Amplitude Of The Compound Motor Action Potential (Cmap) Were Compared Before And After Yoga Training.
(K. K. Kelley et al., 2019)	tree pose (Vrksashana), half moon pose (Ardha Chandrasana) and warrior III (Virabadrasana) when compared to a rest pose (Mountain pose)	the anterior tibialis (TA), gastrocnemius (GA), rectus femoris (RF) and biceps femoris (BF) muscles	surface EMG	the SENIAM (Surface ElectroMyoGraphy for the Non-Invasive Assessment of Muscles) protocol. Leads were attached to a battery operated 16-channel transmitter.

 UGC CARE Listed (Group -I) Journal Volume 11, Iss 12, 2022

(K. Kelley et al., 2018)	Downward Facing Dog, Half-Moon, Tree, Chair, And Warrior Three Pose.	Anterior Tibialis (Ta), Medial Head Of The Gastrocnemius (Ga), Rectus Femoris (Rf), Bicep Femoris (Bf), And Gluteus Medius (Gm)	Surface Electrodes	The Surface Electrodes Used For Emg Collection Were Ma300 (Motion Lab Systems, Baton Rouge, La). Emg Data Was Collected Via A Single-Ended Amplifier With Common Mode Rejection Ration (Ccmr) Of 130 Db.
(Ekstrom et al., 2007)	Active Hip Abduction, Bridge, Unilateral-Bridge, Side-Bridge, Prone-Bridge On Elbows And Toes, Quadruped Arm/Lower Extremity Lift, Lateral Step-Up, Standing Lunge, And Using The Dynamic Edge.	The Rectus Abdominis, External Oblique Abdominis, Longissimus Thoracis, Lumbar Multifidus, Gluteus Maximus, Gluteus Medius, Vastus Medialis Obliquus, And Hamstring Muscles Were Studied.	Surface EMG	Electromyographic (EMG) Analysis Can Provide A Measure Of Muscle Activation So That The Clinician Can Have A Better Idea About The Effect The Exercise May Have On The Muscle For Strength, Endurance, Or Stabilization.
(Dewan Et Al., 2023)	16 Different Yoga Poses In Standing, Kneeling, Supine, Or Prone Positions In Random Order.	Rectus Abdominis (RA) And Transverse Abdominis (TA), Gluteus Medius (GM), And Erector Spinae (ES)	Surface Electromyography	The Signal Of Each Muscle Was Processed And Normalized To Its Maximum Voluntary Isometric Contraction (MVC).

ISSN PRINT 2319 1775 Online 2320 7876

Research paper **© 2012 IJFANS. All Rights Reserved, UGC CARE Listed (Group -I) Journal Volume 11, Iss 12, 2022**

(Beazley Et Al., 2017)	Plank, Upward-Facing Dog, Chair And Dominant-Side Warrior 1.	Rectus Abdominis (RA), Abdominal Obliques (AO), Lumbar Extensors (LE), And Gluteus Maximus (GMX)	Surface Electromyography	Surface Electromyography Was Used. Data Were Expressed As 100% Of A Maximum Voluntary Isometric Contraction.
(Liu et al., 2021)	Chair (Sanskrit Name: Utkatasana), Tree (Vrksasana), Warrior 1 (Virabhadrasana 1), Warrior 2 (Virabhadrasana 2), And Warrior 3 (Virabhadrasana 3).	The Vastus Lateralis (VL), Rectus Femoris (RF), Vastus Medialis (VM), Bicep Femoris (BF), And Semitendinosus (SEMI) For Collecting Surface EMG Signals.	Bipolar Signals Were Recorded By Pairs Of 10 Mm Diameter Ag/Agcl Surface Disc Electrodes Placed At 20 Mm (Center-To-Center).	Electromyography ((Noraxon U.S.A. Inc., Scottsdale, AZ, USA) Was Used To Detect Muscle Activity Signals.
(Petrofsky Et Al., 2005)	Breathing Exercise Performed In The Seated Position.	The Right And Left Rectus Abdominis And Of The Right And Left External Oblique Muscles	The EMG Was Recorded Through 2 Bipolar Vinyl Adhesive Electrodes (Silver Silver-Chloride) With An Active Surface Area Of 0.5 Cm2.	EMG Was Amplified Using A 4-Channel EMG Amplifier Whose Frequency Response Was Flat From DC To 1000 Hz.The Common Mode Rejection Ratio Of The Amplifier Was Greater Than 120 Db.The EMG Was Digitized At 1,000 Samples/Sec By A Biopac (Biopac Corp.,Santa Barbara, CA) 16-Bit Analog-To-Digital Converter And Displayed And Stored On A Computer For Later Analysis.The Amplitude

				Of EMG Was Assessed By Digitizing And Half Wave Rectified The Raw EMG And Calculating The Root Mean Square Average (RMS) Of The EMG.
(Ni, Mooney, Balachandran, et al., 2014)	Chr Chair (Utkaasana), Dogdwn Downward Facing Dog (Adho Mukha Svanasana) ,Dogup Upward Facing Dog (Urdhva Mukha Svanasana) Ffold Forward Fold (Uttanasana) Hlift Halfway Lift (Urdhva Mukha Uttanasana) Mntdwn Mountain Pose With Arms Down (Tadasana) Mntup Mountain Pose With Arms Up (Urdhva Hastasana) Plnkhi High Plank (Dandasana) Plnklow Low Plank	PECS Pectoralis Major Sternal Head Deltant Anterior Deltoid Deltmed Medial Deltoid BB Biceps Brachii Tri Triceps Brachii TRAPUP Upper Trapezius TRAPMID Middle Trapezius RAM Rectus Abdominis ES Erector Spinae RF Rectus Femoris VM Vastus Medialis BF Biceps Femoris Gastroclat Gastrocnemius Lateralis TA Tibialis Anterior	Surface Electromyography	Surface Electromyography (EMG) Data Were Normalized Across Subjects And Collection Days, Using EMG Results From 3 S Maximal Voluntary Contractions (MVC) Targeting Each Muscle.

ISSN PRINT 2319 1775 Online 2320 7876

 UGC CARE Listed (Group -I) Journal Volume 11, Iss 12, 2022

	(Chaturanga Dandasana) Warno-DOM Non-Dominant Side Warrior 1 Pose (Virabhadrasana I) Wardom Dominant Side Warrior 1 Pose			
(Kaur et al., 2016)	squat posture (a yogic posture)	Vastus Medialis (VM) and Vastus Lateralis (VL) muscles (quadriceps group)	EMG data were acquired using a 4-Channel Wireless EMG BIOPAC Inc. MP 150 system (CMRR: 110dB at 50/60 Hz and Gain: 5-50,000, Input Impedance: 2 MΩ).	The data acquisition software (Acqknowledge 4.1, BIOPAC systems Inc.) was set to sampling frequency of 2000 Hz to avoid the aliasing effects as per Nyquist criteria.
(Ni, Mooney, Harriell, et al., 2014)	Halfway Lift, Forward Fold, Downward Facing Dog, Upward Facing Dog, High Plank, Low Plank, Chair, Mountain With Arms Down, Mountain With Arms Up, Warrior 1 (Both Sides).	Upper Rectus Abdominis, Lower Rectus Abdominis, Longissimus Thoracis, External Oblique Abdominis And Gluteus Maximum	Disposable Bipolar Electrodes (Noraxon USA, Scottsdale, AZ)	Ireless EMG Telemetry System (BTS Bioengineering, Milano, Italy) At A Sampling Rate Of 1000 Hz, Using Band-Pass Filtering Between 1 And 500 Hz, Digitized Using A 16-Bit A/D Converter, Amplified (Gain = 2000, CMRR > 110 Bb@50—60 Hz), And Stored On A Personal Computer

ISSN PRINT 2319 1775 Online 2320 7876

 UGC CARE Listed (Group -I) Journal Volume 11, Iss 12, 2022

(Wang et al., 2013)	Chair, Wall Plank, Tree, Warrior II, Side Stretch, Crescent, And One-Legged Balance.	Gluteus Medius (GMED), Hamstrings (HAMS), Vastus Lateralis (VL), And Gastrocnemius (GAS) Muscles	Surface EMG	The EMG Signals Were Filtered According To ISEK Standards, Including, Notch Filtering At 60 Hz, And Band-Pass Filtering Between 20 And 500 Hz. A Root Mean Square Smoothing Algorithm, With A 75-Millisecond Constant Window, Was Used To Smooth The EMG Data
(Lehecka et al., 2021)	Tree Pose, Warrior Two Pose, Warrior Three Pose, Half Moon Pose, And Bird Dog Pose	Gluteus Maxim us, Gluteus Medius	Bi-Polar Wireless Surface EMG Electrodes	All Surface EMG Data Were Collected At 4000 Hz Using A Noraxon 880-16 Ultium Dash/ESP 16 Myomuscle And Myomuscle 3.12 Software (Noraxon, Scottsdale, AZ).
(Bolgla Et Al., 2018)	Chair, Plank, Dog, And Warrior	Rectus Abdominis (RA), Abdominal Obliques (AO), Lumbar Extensors (LE), And Gluteus Maximus (GMX)	Surface Electromyography	A Four-Channel Wireless EMG System Collected All EMG Data, Which Were Sampled At 2000 Hz And Band-Pass Filtered Between 20 And 450 Hz. Unit Specifications Also Included A Common Mode Rejection Ratio Greater Than 80 Db. All Data Were Root-Mean-Squared (RMS) Over A 30-Ms Moving Window . For The Mvics, A Computer Algorithm Determined The Maximum RMS Amplitude Over A Moving 500-Ms Average Window Across The

ISSN PRINT 2319 1775 Online 2320 7876

 UGC CARE Listed (Group -I) Journal Volume 11, Iss 12, 2022

				Mvics . The Window With The Highest Amplitude Was Used To Normalize All Data As A Percentage Of MVIC (% MVIC)
(Chopp-Hurley Et Al., 2018)	Row Pose, Dancer's Pose Left , Dancer's Pose Right , Downward Dog, Locust Arms Back , Locust Arms Forward, Modified Plank Clasped, Modified Plank Shoulder, Plank , Reverse Tabletop , Side Angle, Side Plank, Tree Pose, Upward Dog , Warrior II	Upper Trapezius, Middle Trapezius, Lower Trapezius, And Serratus Anterior Muscle	Surface Adhesive Ag/Agcl Electrode	Data Recorded During The Yoga Postures Were Normalized To The Peak EMG Amplitude Recorded For Each Muscle, Regardless Of Which MVIC Test Elicited The Maximum.

Conclusion:

A review of EMG studies covering several complicated yoga skills, including various experimental approaches, makes it nearly impossible to draw any firm findings. We attempted to establish guidelines for the EMG technique at the outset of the evaluation; we referenced to table 2, and on various instances (for each sport), we pointed out some of the limits of EMG due to its partially descriptive nature.

The diagnosis of neuromuscular diseases, improving athletic performance, and improving human-machine interface all benefit greatly from the adaptable and potent electromyography tool. The use of electromyography (EMG) is anticipated to grow as technology progresses, offering new insights into how muscles work and creating novel opportunities for healthcare, rehabilitation, and human enhancement.

ISSN PRINT 2319 1775 Online 2320 7876

 UGC CARE Listed (Group -I) Journal Volume 11, Iss 12, 2022

EMG and yoga poses are a broad topic, as was previously said, making a thorough review nearly difficult. Relevant data are dispersed throughout numerous journals in the fields of applied physiology, ergonomics, biomechanics, sports science, and many other local sorts of reporting. Consequently, despite our best efforts, many significant elements and perhaps significant publications may have been missed from this review.

References

Basmajian, J. V. (1985). Description and analysis of the EMG signal. *Muscles Alive. Their Functions Revealed by Electromyography*, 65–100.

Beazley, D., Patel, S., Davis, B., Vinson, S., & Bolgla, L. (2017). Trunk and hip muscle activation during yoga poses: Implications for physical therapy practice. *Complementary Therapies in Clinical Practice*, *29*, 130–135. https://doi.org/10.1016/j.ctcp.2017.09.009

Bolgla, L. A., Amodio, L., Archer, K., Estes, J., Leung, R., Magoni, K., Mullikin, A., Roberts, D., Weems, M., & Beazley, D. (2018). Trunk and hip muscle activation during yoga poses: Do sex-differences exist? *Complementary Therapies in Clinical Practice*, *31*, 256–261. https://doi.org/10.1016/j.ctcp.2018.03.006

Bouisset, S. (1973). EMG and muscle force in normal motor activities. In *New Concepts of the Motor Unit, Neuromuscular Disorders, Electromyographic Kinesiology* (Vol. 1, pp. 547–583). Karger Publishers.

Buchthal, F. (1985). Electromyography in the Evaluation of Muscle Diseases. *Neurologic Clinics*, *3*(3), 573–598. https://doi.org/10.1016/S0733-8619(18)31023-5

Burden, A. M., Trew, M., & Baltzopoulos, V. (2003). Normalisation of gait EMGs: A re-examination. *Journal of Electromyography and Kinesiology*, *13*(6), 519–532.

Cabri, J. M. H. (1991). Isokinetic strength aspects in human joints and muscles. *Applied Ergonomics*, *22*(5), 299–302.

Chopp-Hurley, J. N., Prophet, C., Thistle, B., Pollice, J., & Maly, M. R. (2018). Scapular Muscle Activity During Static Yoga Postures. *Journal of Orthopaedic & Sports Physical Therapy*, *48*(6), 504–509. https://doi.org/10.2519/jospt.2018.7311

Clarys, J. P., & Cabri, J. (1993a). Electromyography and the study of sports movements: A review. *Journal of Sports Sciences*, *11*(5), 379–448. https://doi.org/10.1080/02640419308730010

Clarys, J. P., & Cabri, J. (1993b). Electromyography and the study of sports movements: A review. *Journal of Sports Sciences*, *11*(5), 379–448. https://doi.org/10.1080/02640419308730010

Clarys, J. P., & Olbrecht, J. (1983). Peripheral control of complex swimming movements using telemetric and conventional electromyography. In *Motorik-und bewegungsforschung* (pp. 111–116).

De Luca, C. J. (1979). Physiology and mathematics of myoelectric signals. *IEEE Transactions on Biomedical Engineering*, *6*, 313–325.

Delgado, T. E., Buchheit, W. A., Rosenholtz, H. R., & Chrissian, S. (1979). Intraoperative Monitoring of Facial Muscle Evoked Responses Obtained by Intracranial Stimulation

ISSN PRINT 2319 1775 Online 2320 7876
 UGC CARE Listed (Group -I) Journal Volume 11, Iss 12, 2022

of the Facial Nerve: A More Accurate Technique for Facial Nerve Dissection. *Neurosurgery*, *4*(5), 418.

Deshi, R. K., & Das, Dr. P. K. (2023a). The impact of standing Yogasana on core muscle strength and function: A thematic review. *International Journal of Yogic, Human Movement and Sports Sciences*, *8*(2), 108–111. https://doi.org/10.22271/yogic.2023.v8.i2b.1442

Deshi, R. K., & Das, P. K. (2023b). *The impact of standing Yogasana on core muscle strength and function: A thematic review*. https://doi.org/10.22271/yogic.2023.v8.i2b.1442

Deshi, R. K., & Mishra, Dr. V. B. (2023). The impact of Utkatasana and Virabhadrasana 2 on quadriceps and hamstring muscle groups: A thematic review. *International Journal of Physiology, Health and Physical Education*, *5*(1), 05–08. https://doi.org/10.33545/26647265.2023.v5.i1a.39

Devaraju, V., Ramesh, A. B., Alva, K. K., Debur, V. R., & Omkar, S. (2019). A Mathematical Method for Electromyography Analysis of Muscle Functions during Yogasana. *International Journal of Yoga*, *12*(3), 240–246. https://doi.org/10.4103/ijoy.IJOY_63_18

Dewan, M., Nijhawan, M., Chhabra, H. S., Shandilya, S., Kumar, P., & Phadke, V. (2023). Electromyographic analysis of trunk and hip muscles during Yoga poses prescribed for treating chronic low back pain. *Journal of Bodywork and Movement Therapies*, *36*, 117–124. https://doi.org/10.1016/j.jbmt.2023.06.007

Ekstrom, R. A., Donatelli, R. A., & Carp, K. C. (2007). Electromyographic Analysis of Core Trunk, Hip, and Thigh Muscles During 9 Rehabilitation Exercises. *Journal of Orthopaedic & Sports Physical Therapy*, *37*(12), 754–762. https://doi.org/10.2519/jospt.2007.2471

Enoka, R. M. (1995). Morphological features and activation patterns of motor units. *Journal of Clinical Neurophysiology*, *12*(6), 538–559.

Govindaraj, R., Karmani, S., Varambally, S., & Gangadhar, B. N. (2016). Yoga and physical exercise – a review and comparison. *International Review of Psychiatry*, *28*(3), 242–253. https://doi.org/10.3109/09540261.2016.1160878

Hogan, N., & Mann, R. W. (1980). Myoelectric signal processing: Optimal estimation applied to electromyography-Part I: Derivation of the optimal myoprocessor. *IEEE Transactions on Biomedical Engineering*, *7*, 382–395.

Kadefors, R., Arvidsson, A., Herberts, P., & Petersén, I. (1983). EMG DATA-PROCESSING IN ERGONOMICS, WITH EMPHASIS ON STUDIES OF SHOULDER MUSCLE LOAD. *Progress in Clinical Neurophysiology*, *10*, 273–286.

Kadefors, R., Broman, H., & de Luca, C. J. (1980). Units, terms and standards in the reporting of EMG research. *Boston: The Ad Hoc Committee of the International Society of Electrophysiogical Kinesiology*. http://www.bu.edu/nmrc/files/2013/12/B-4.pdf

Kadefors, R., & Petersén, I. (1970). Spectral analysis of myo-electric signals from muscles of the pelvic floor during voluntary contraction and during reflex contractions connected with ejaculation. *Electromyography*, *10*(1), 45–68.

Kadefors, R., Petersen, I., & Broman, H. (1973). Spectral analysis of events in the electromyogram. In *New Concepts of the Motor Unit, Neuromuscular Disorders, Electromyographic Kinesiology* (Vol. 1, pp. 628–637). Karger Publishers.

Katirji, B. (2002). *The clinical electromyography examination An overview*.

Kaur, M., Nara, S., Shaw, D., & Bhatia, D. (2016). EMG asymetricity of selected knee extensor muscles in sustained squat posture (A Yogic Posture) of athletes in relation to their gender and performance. *J Nov Physiother*, *6*(322), 2.

Kelley, K. K., Giannico, K., Lesnett, G., & Romano, A. (2019). A comparison of EMG output of four lower extremity muscles during selected yoga postures. *Journal of Bodywork and Movement Therapies*, *23*(2), 329–333. https://doi.org/10.1016/j.jbmt.2019.01.005

Kelley, K., Slattery, K., & Apollo, K. (2018). An electromyographic analysis of selected asana in experienced yogic practitioners. *Journal of Bodywork and Movement Therapies*, *22*(1), 152–158. https://doi.org/10.1016/j.jbmt.2017.05.018

Kumar, A., Kapse, R. C., Paul, N., Vanjare, A. M., & Omkar, S. (2018). Musculoskeletal Modeling and Analysis of Trikonasana. *International Journal of Yoga*, *11*(3), 201–207. https://doi.org/10.4103/ijoy.IJOY_1_18

Kumar Deshi, R., & Bajpai Mishra, V. (2023). Electromyography Comparisons Of Lower Extremity Muscles During Warrior Two Yoga Pose. *International Organization of Scientific Research*, *10*(6), 30–34. https://doi.org/10.9790/6737-1006013034

Lehecka, B. J., Stoffregen, S., May, A., Thomas, J., Mettling, A., Hoover, J., Hafenstine, R., & Hakansson, N. A. (2021). Gluteal Muscle Activation During Common Yoga Poses. *International Journal of Sports Physical Therapy*, *16*(3), 662–670. https://doi.org/10.26603/001c.22499

Lehman, G. J., & McGill, S. M. (1999). The importance of normalization in the interpretation of surface electromyography: A proof of principle. *Journal of Manipulative and Physiological Therapeutics*, *22*(7), 444–446.

Liu, A.-M., Chu, I.-H., Lin, H.-T., Liang, J.-M., Hsu, H.-T., & Wu, W.-L. (2021). Training Benefits and Injury Risks of Standing Yoga Applied in Musculoskeletal Problems: Lower Limb Biomechanical Analysis. *International Journal of Environmental Research and Public Health*, *18*(16), 8402. https://doi.org/10.3390/ijerph18168402

Marras, W. S. (2000a). Overview of Electromyography in Ergonomics. *Proceedings of the Human Factors and Ergonomics Society Annual Meeting*, *44*(30), 5–534. https://doi.org/10.1177/154193120004403037

Marras, W. S. (2000b). Overview of Electromyography in Ergonomics. *Proceedings of the Human Factors and Ergonomics Society Annual Meeting*, *44*(30), 5-534-5–536. https://doi.org/10.1177/154193120004403037

ISSN PRINT 2319 1775 Online 2320 7876

Research paper© 2012 IJFANS. All Rights Reserved, UGC CARE Listed (Group -I) Journal Volume 11, Iss 12, 2022

McLeod, W. D. (1973). EMG instrumentation in biomechanical studies: Amplifiers, recorders and integrators. In *New Concepts of the Motor Unit, Neuromuscular Disorders, Electromyographic Kinesiology* (Vol. 1, pp. 511–518). Karger Publishers.

Merletti, R., & Farina, D. (2009). Analysis of intramuscular electromyogram signals. *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences*, *367*(1887), 357–368. https://doi.org/10.1098/rsta.2008.0235

Mullerpatan, R. P., Agarwal, B. M., & Shetty, T. V. (2020). Exploration of Muscle Activity Using Surface Electromyography While Performing Surya Namaskar. *International Journal of Yoga*, *13*(2), 137–143. https://doi.org/10.4103/ijoy.IJOY_72_19

Ni, M., Mooney, K., Balachandran, A., Richards, L., Harriell, K., & Signorile, J. F. (2014). Muscle utilization patterns vary by skill levels of the practitioners across specific yoga poses (asanas). *Complementary Therapies in Medicine*, *22*(4), 662–669. https://doi.org/10.1016/j.ctim.2014.06.006

Ni, M., Mooney, K., Harriell, K., Balachandran, A., & Signorile, J. (2014). Core muscle function during specific yoga poses. *Complementary Therapies in Medicine*, *22*(2), 235–243. https://doi.org/10.1016/j.ctim.2014.01.007

Perry, J., & Bekey, G. A. (1981). EMG-force relationships in skeletal muscle. *Critical Reviews in Biomedical Engineering*, *7*(1), 1–22.

Petrofsky, J. S., Cuneo, M., Dial, R., & Morris, A. (2005). Muscle activity during yoga breathing exercise compared to abdominal crunches. *Journal of Applied Research in Clinical and Experimental Therapeutics*, *5*(3), 501.

Petrofsky, J. S., & Lind, A. R. (1980). Frequency analysis of the surface electromyogram during sustained isometric contractions. *European Journal of Applied Physiology and Occupational Physiology*, *43*, 173–182.

Podnar, S., & Mrkai?, M. (2003). Size of motor unit potential sample. *Muscle & Nerve*, *27*(2), 196–201. https://doi.org/10.1002/mus.10310

Pullman, S. L., Goodin, D. S., Marquinez, A. I., Tabbal, S., & Rubin, M. (2000). utility of surface EMG: Report of the Therapeutics and Technology Assessment Subcommittee of the American Academy of Neurology. *Neurology*, *55*(2), 177.

Quan, D., & Bird, S. J. (1999). Nerve conduction studies and electromyography in the evaluation of peripheral nerve injuries. *Univ Pa Orthop J*, *12*, 45–51.

Reinstein, L., Twardzik, F. G., & Mech, K. F. (1987). Pneumothorax: A complication of needle electromyography of the supraspinatus muscle. *Archives of Physical Medicine and Rehabilitation*, *68*(9), 561–562.

Rutkove, S. B. (2001). Effects of temperature on neuromuscular electrophysiology. *Muscle & Nerve: Official Journal of the American Association of Electrodiagnostic Medicine*, *24*(7), 867–882.

Sherif, M. H., & Gregor, R. J. (1986). Modelling myoelectric interference patterns during movement. *Medical and Biological Engineering and Computing*, *24*, 2–9.

ISSN PRINT 2319 1775 Online 2320 7876

 UGC CARE Listed (Group -I) Journal Volume 11, Iss 12, 2022

Sousa, A. S., & Tavares, J. M. R. (2012). Surface electromyographic amplitude normalization methods: A review. *Electromyography: New Developments, Procedures and Applications*. https://repositorio-aberto.up.pt/handle/10216/64430

Suma, K. V., Lakshmi Shrinivasan, V. C., & Nagendra, B. N. (2022). Analysis of Muscle Function for Postural Correction Using Surface EMG Signals. *Webology (ISSN: 1735-188X)*, *19*(2). https://www.webology.org/data-cms/articles/20220215114934amwebology%2019%20(2)%20-%20205%20pdf.pdf

Trakroo, M., Bhavanani, A. B., Pal, G. K., Udupa, K., & Krishnamurthy, N. (2013). *A comparative study of the effects of asan, pranayama and asan-pranayama training on neurological and neuromuscular functions of Pondicherry police trainees—PMC*. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3734645/

Viitasalo, J. H., & Komi, P. V. (1975). Signal characteristics of EMG with special reference to reproducibility of measurements. *Acta Physiologica Scandinavica*, *93*(4), 531–539.

Wang, M.-Y., Yu, S. S.-Y., Hashish, R., Samarawickrame, S. D., Kazadi, L., Greendale, G. A., & Salem, G. (2013). The biomechanical demands of standing yoga poses in seniors: The Yoga empowers seniors study (YESS). *BMC Complementary and Alternative Medicine*, *13*, 8. https://doi.org/10.1186/1472-6882-13-8

Wu, Y., Martnez Martnez, M. N., & Orizaola Balaguer, P. (2013). Overview of the Application of EMG Recording in the Diagnosis and Approach of Neurological Disorders. In Dr. H. Turker (Ed.), *Electrodiagnosis in New Frontiers of Clinical Research*. InTech. https://doi.org/10.5772/56030

Yang, J. F., & Winter, D. A. (1984). Electromyographic amplitude normalization methods: Improving their sensitivity as diagnostic tools in gait analysis. *Archives of Physical Medicine and Rehabilitation*, *65*(9), 517–521.