



To develop and validate an integrated yoga module for volleyball players

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Abstract

Background: Volleyball is a team sport where two teams are separated by a net and dynamic in nature that requires well developed physical and psychological profile. Most of the injuries in volleyball are overuse type injury. Yoga is a non-invasive, non-pharmacological and cost-effective mode and can be used as therapeutic, rehabilitative and preventive accessory. Available evidences suggests that yoga helps to attain states of health, both at physical and mental levels.

Method: A customized protocol was developed by reviewing the classical yoga texts and research evidence, containing 77 yoga practices was validated by 30 subject matter experts (SMEs). Data was analyzed using the statistical test Lawshe's Content Validity ratio (CVR) to check the content validity.

Result: The CVR ratio for all 77 yoga practices for the volleyball players is 0.33 for 30 experts, according to Lawshe's CVR ratio the minimum value. 43 practices had a CVR score of ≥ 0.33 , indicating high content validity ($p \leq 0.05$). Remaining practices had a CVR score of < 0.33 , indicating low content validity and these practices can be used as complimentary poses for important postures to align the body and mind.

Conclusion: Out of 77 practices, 43 were found to be essential (CVR 0.33) and 34 were not found to be essential (CVR < 0.33). Based on the findings of this study, the Integrated Yoga Module for volleyball players suggests good content validity.

Keywords: team sport, volleyball players, yoga, integrated yoga module (IYM), physical and mental wellness

Introduction

Volleyball Game Demands

Volleyball is a game of an intermittent nature, where maintaining a high level of performance over time is required. During game volleyball athletes experience repetitive bouts of intense exercise, with brief rest periods (Reeser & Bahr, 2003) [33]. There are different positions on a volleyball court and players take on different roles and hence require a different skill. For excellent performance in volleyball, athletes need well-developed anthropometric, physiological and psychological profile. High intensity game includes activity like jumping, diving, sprints and multi-directional court movements, for that athlete should have great anthropometric, physiological and psychological profile.

Vertical jump is a major criterion for volleyball performance and as per player's position different types of vertical jumps are performed *viz.* Countermovement jump (CMJ), Spike jump (SPJ), Block jump (BJ), Squat jump (SJ). Upper limb strength is also requisite for blocking and serving in the volleyball game. Therefore, ball throwing and jumping ability are important factors for successful volleyball performance. During the game, players have to make fast movements to do blocking and defence, this requires great agility and Speed. Total energy demands of the sport of volleyball (including both work and rest periods) are met by a combination of all three energy systems: ATP-CP system, anaerobic glycolytic system and aerobic metabolism (Gionet, 1980). Anthropometric characteristics such as body height and body mass are considered decisive factor for good performance in

volleyball and are used as a criterion for the selection of volleyball players (Malousaris *et al.*, 2008) [18]. High values of body weight and body fat among volleyball players might be disadvantageous for them in attaining a good jumping height as they have to lift a greater weight (Nikolaidis, 2013) [23]. Heart rate and heart rate variability monitoring is a popular tool for measuring internal load and cardiovascular fitness in athletes. High-intensity exercise leads to higher heart rate (HR) and lower heart rate variability (HRV), which may be due to increased sympathetic nerve activity and decreased vagal modulation of the heart. (Ramos-Campo *et al.*, 2016). To achieve all these demands strength and conditioning professionals are constantly looking for effective training modalities for this purpose (Marques *et al.*, 2006) [19]. High intensity training and insufficient recovery may generate negative adaptations to training, leading the athlete to non-functional overreaching or overtraining (Borresen & Lambert, 2009; Foster *et al.*, 2001; Kentta & Hassmen, 1998) [6, 8]. Therefore, it is essential to monitor the performance levels of athletes throughout the season to avoid negative adaptations to training. Sports injuries are related to diverse factors that may classified as Intrinsic and Extrinsic (Reeser and Bahr, 2003) [33]. Volleyball playing involves jumping, stretching, diving and multidirectional movements that place the players to greater risk of injuries. Because of non-contact nature of game, where players are separated by the net, volleyball injuries occur at the net during attacks or blocking, when the athletes land on the feet of other players (Bahr & Bahr, 1997) [2]. The most commonly injured area is ankle followed by the knee, shoulders, fingers and back

(Bahr *et al.* 1994; Aagaard & Jørgensen, 1996)^[3, 1]. Ankle and finger injuries are categorized as acute injuries, whereas shoulder and knee injuries are overuse injuries (Aagaard & Jørgensen, 1996)^[1].

The development of motor skills is one of many to create multifaceted personalities of volleyball players capable of creative self-realization and competitive process (Vranic, 2013). Jumping is a distinctive feature in volleyball. While jumping spikes, blocks and serves are performed, during high-intensity play, due to great speed of the ball and its short flight players have to react and move quickly. For all the above, volleyball players require longitudinal dimensionality of a skeleton, explosive power, endurance, good prediction i.e., placing and reaction. Playing in defence requires good flexibility, coordination and speed of movement when changing direction and body posture (Bokan, 2009)^[5].

Knowledge of Sports psychology helps the coach to find solutions to the problems faced by the athlete/team during competition and training. During competition, when both teams are equally talented, significant mental stress can arise for athletes. In such situations, psychological concepts and strategies play an important role in achieving a goal as athletes are prepared to quickly identify an efficient solution (Reeser & Bahr, 2003)^[33]. Sports psychology employs certain methods to teach athletes how to perform better in challenging conditions. Numerous studies have confirmed the influence of various psychological attributes such as achievement motivation, sports competitive anxiety, sports aggression, self-confidence etc. on sports performance (Hardy *et al.*, 1996)^[12]. Sports psychologists may use a variety of interventions, such as psychological skills training (PST) which is the most common intervention is used (Röthlin *et al.*, 2016)^[34]. The PST includes a set of techniques, namely self-talk, imagery, goal setting and arousal regulation (Hardy *et al.*, 1996; Vealey, 2007)^[12, 40]. Mindfulness-based intervention (MI) is also used as an alternative in sport (Gardner & Moore, 2012). There have been many studies using these techniques to cope with stress and anxiety and improve sports performance.

Yoga for improving sports performance

The Taittiriya Upanishad describes the concept of Pancha koshas, that integrating the wellbeing of each of these koshas emphasizes holistic health. According to the Kosha theory, human nature consists of physical and psychological aspects that function as a holistic system. These layers are intertwined and affect one another and each layer influences overall health (Mishra *et al.*, 2019)^[20]. Yoga is a non-invasive, non-pharmacological and cost-effective mode and can be used as therapeutic, rehabilitative and preventive accessory. Yoga is based on the principle of integrating the whole body and emphasizing the quality of life. The training program for athletes can be designed by integrating all yogic practices in traditional sports program. The integrated yoga module (IYM) comprises loosening exercises, *sukshma vyayama*, *yogasanas*, breathing exercises, *pranayama*, *kriyas*, meditation and relaxation techniques that help in achieving physical and mental wellbeing.

Traditional sports training program employs specific activities to improve the specific areas of fitness and yoga is an activity that involves important aspects of athletic performance, including balance, flexibility, muscle strength and muscular endurance. The physical practice of yoga is

the synchronization of regular steady breathing and series of static postures in which all target and supporting muscle groups are involved.

Majority of studies have proved the beneficial effects of yoga on anthropometrical and physiological parameters such as reduced body weight, BMI, fat (%), pulse rate, systolic blood pressure and diastolic blood pressure (Karak *et al.*, 2015)^[13]. A decrease in respiratory rate, heart rate, low frequency (LF%) band and increased high frequency (HF%) has also been shown after the practice of *trataka* (Raghavendra & Ramamurthy, 2014)^[28]. In athletes, the practice of *pranayama* showed the higher work rates with less oxygen consumption per unit work without increase in blood lactate levels (Raju *et al.*, 1994)^[31]. Yoga has also been found to have a positive effect on cardiovascular fitness, aerobic and anaerobic power (Rajan *et al.*, 2014)^[30]. There is a significant improvement in hand grip strength after the practice of high frequency yoga breathing (Telles *et al.*, 2014)^[38]. Regular yoga practice helps to increase muscular strength, muscular endurance, flexibility, agility and cardiorespiratory endurance.

Repetitive strain injuries (RSIs) are associated with repetitive actions, vigorous exertion, and mechanical compression that damage the muscles, nerves, tendons, ligaments, joints, cartilage and blood vessels. Any physical or musculoskeletal injury is likely to affect range of motion (ROM), flexibility, and endurance, depending on the grade of the injury. Several studies indicate yoga to enhance strength, flexibility and range of motion as part of injury rehabilitation or as prevention of injury (Pauline & Rintaugu, 2011; Goel, 2015)^[26, 10]. Inadequate ROM increases the risk of injury to the connecting muscles and joints. Yoga works on the muscles and joints in three planes of motion through sagittal, frontal and transverse motion which activate the smaller muscles to support the primary muscles which allows the development of muscle strength. The increased range of motion is due to the static stretching nature of the *asanas* as prolonged stretching leads to an increase in the length of the connective and muscle tissue (Goel, 2015)^[10]. 12 weeks yoga practice showed the improvements in shoulder flexion, hip flexion, hip extension and abduction range of motion (Pauline and Rintaugu, 2011)^[26]. Many studies have shown the remarkable effect of yoga therapy on chronic low back pain (CLBP), degenerative spondylosis, knee injuries rehabilitation and increased ankle motion. Fine motor skills and proper muscle activation are required when performing movements and yoga focuses on engaging the muscles needed to function with minimal effort. Many *asanas* in yoga improve balance by stimulating somatosensory and vestibular systems (Prado *et al.*, 2014)^[27]. Stress and anxiety are one of the major aspects that affect the performance of athletes during the game. Traditional sports psychology teaches athletes to control internal states in order to increase their ability to achieve an ideal mental state beneficial for optimal performance (Hardy *et al.*, 1996)^[12]. Athletes face utmost physical and psychological stress every day, which can contribute to injuries, over-training, burnout and other physical and mental health problems. Sleep quality is one of the essential parameters for improving recovery–stress balance in athletes (Loch *et al.*, 2019)^[16]. Yoga nidra (YN) reduces hyper arousal and stress-related biological indices, such as skin conductance and cortisol levels (Kumar & Joshi, 2009)^[15] by inducing a hypothalamic response where stimulation

of parasympathetic and suppression of sympathetic nervous system activity is involved (Dol, 2019) [7]. Some evidences summarized that yoga-based exercises increased PNS activity and thalamic GABA levels which are associated with heightened mood and decreased anxiety (Streeter *et al.*, 2010) [37]. Yoga brings control over breathing and that works effectively in improving the psychomotor co-ordination and thus improves attention, concentration span, memory, awareness and cardiovascular endurance which helps in enhancing the sports performance of the athlete (Nagaraj *et al.*, 2019) [21]. Yoga is effective in increasing mindfulness and well-being and reducing perceived stress and anxiety. Practicing yoga may have a distinctively positive and diverse impact on athletic performance. Abovementioned evidences illustrate that yoga acts as mind-body activity which may benefit physiological, psychological and emotional aspects of athlete's by improving aerobic and anaerobic capacity, heart rate variability, heart-beat, flexibility, balance, muscular strength and endurance, reduce risks of injury, reduces sports anxiety, stress, and depression by enhancing motor skills, mood state and quality of life. All these variables are considered most important for every athlete as the athlete needs to practice different training regimens for competitions and athletes are challenged physically and psychologically and yoga brings balance to both the states.

Materials and Method

The designing and validation of Integrated Yoga Module (IYM) for volleyball players were carried out in the following steps:

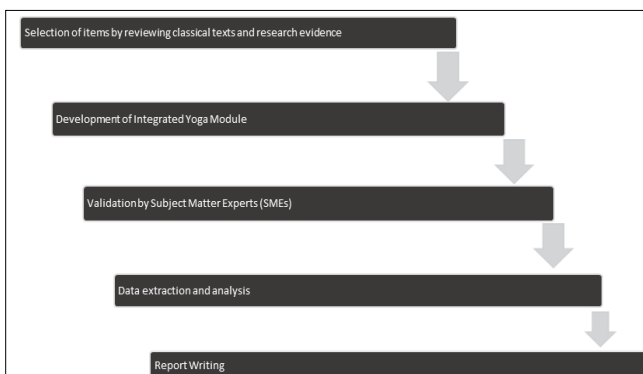


Fig 1: Steps for designing and validation of Integrated Yoga Mod

Step 1: Development of integrated yoga module

A customized protocol was developed by reviewing classical texts and research evidences about Yoga and Volleyball Sports. This preliminary yoga module is comprised of 77 practices.

Inclusion criteria

- All classical texts of yoga, research publications, and research thesis describing yoga, sports, yoga for sports, physical and psychological demands of volleyball player, volleyball related injuries, yoga for prevention of injuries.
- To check the content validity, the experts were selected amongst Yoga doctorates (PhD in Yoga)/ Doctor of Medicine (MD) in yoga with minimum experience of 5 years and Master in Yoga (MSc- Yoga/ Yoga therapist) having minimum 7 years' experience.

Exclusion criteria

- Yoga therapists with less than 5 years' experience were excluded.

Step 2: Validation of the integrated yoga module by experts

A panel of 30 experts with the mentioned qualifications was prepared to determine the validity of the content. These experts were requested to validate the practices in the proposed module on a three-point scale *viz.*, Not Essential, Useful but not Essential and Essential.

- Not Essential:** Indicates that no role in improving athletic performance.
- Useful but not essential:** useful in improving general wellbeing, but the benefits are not specific to volleyball athlete's physiological needs.
- Essential:** Very useful for the volleyball athletes.

For calculation of Content Validity Ratio (CVR), the expert panel was asked to comment on the requirement of the items included. After validation, data were analyzed using Lawshe's CVR.

Step 3: Statistical analysis

Thirty SMEs validated all the 77 practices. Lawshe's CVR was calculated for all the 77 items using this formula,

$$CVR = \frac{N_e - \left(\frac{N}{2}\right)}{\frac{N}{2}}$$

Where in,

N = 30 (total number of SME panelists)

N_e = number of SME panelists indicating "essential"

N_{critical} = 20 (minimum number of experts required to agree an item as "essential")

CVR_{critical} = 0.33 (minimum value of the CVR against the number of panelists)

p value = ≤0.05 (probability of success)

Lawshe's CVR critical value for 30 SMEs is 0.33, which means all items with CVR ≥0.33 are valid and essential for the module.

Step 4: Report writing

The study report was prepared incorporating the results and discussion

Result

A Structured Integrated Yoga Module for the volleyball game containing 77 yoga practices was validated by 30 SMEs. As per Lawshe's CVR critical value the minimum value for 30 experts is 0.33, this means that the CVR ratio obtained is found to be important for evaluating the content validity of the module and the module is valid for use as an intervention for volleyball players, which is approved by yoga experts. It has been found that out of 77 IYM practices selected for validation, 43 practices had a CVR score of ≥0.33, indicating high content validity (p≤0.05). These practices are listed as in (Table- 1). Other practices had a CVR score of <0.33 (Table-2), indicating low content validity and these practices can be used as complimentary poses for important postures to align the body and mind. 43 practices in were considered essential for volleyball players, thus, the final CVR satisfied the minimum value, as per Lawshe's CVR.

Table 1: Yoga practices with CVR score 0.33 and above (≥ 0.33)

Sr. No.	Practices	CVR
Loosening exercises		
1	Jogging (Slow Jogging, Forward Jogging, Backward jogging, Side Wise Jogging)	0.8
2	Forward and Backward Bending	0.8
3	Side Bending	0.6
4	Pawanmuktasana Kriya	0.53
5	Twisting	0.6
Sukshma Vyayama		
6	Scandasanchalana (Shoulder Movements)	0.8
7	Katisanchalana (Waist Movements)	0.4
8	Janusanchalana (Knee Movements)	0.53
9	Padasanchalana (ankle Movements)	0.53
Breathing practices		
10	Hands in & out breathing	0.4
11	Hands Stretch Breathing	0.5
12	Ankle Stretch Breathing	0.5
13	Straight leg Raise Breathing	0.86
14	Suryanamaskar (19 Dynamic & 1 Slow)	0.73
Asanas		
15	Adho Mukha Svanasana	0.4
16	Ardha kati Chakrasana	0.53
17	Bhujangasana	0.73
18	Chakrasana	0.73
19	Dhanurasana	0.53
20	Gomukhasana	0.33
21	Naukasana	0.4
22	Navasana	0.4
23	Padahasthasana	0.4
24	Pariivrita Trikonasana	0.6

Table 2: Yoga practices with CVR score below 0.33 (< 0.33)

Sr. No.	Practice List	CVR
Sukshma Vyayama		
1	Greevasanchalana (Neck Movements)	0.2
Breathing Practices		
2	Dog Breathing	-0.2
3	Rabbit Breathing	-0.26
4	Tiger Breathing	0.13
5	Shasankasana Breathing	0.2
Asanas		
6	Ardha Matsyendrasana	0.06
7	Bakasana	-0.06
8	Bhadrasana	-0.06
9	Garudasana	0.13
10	Halasana	-0.06
11	Hanumanasana	0.13
12	Koormasana	0.0
13	Kukkutasana	0.06
14	Makarasana	-0.2
15	Marichyasana	-0.33
16	Marjariasana	0.0
17	Markatasana	0.0
18	Matsyasana	-0.26
19	Mayurasana	0.13
20	Parsvottanasana	0.06
21	Sarvangasana	0.26
22	Shasankasana	-0.13
23	Shavasana	0.6
24	Ushtrasana	0.26
25	Vakrasana	-0.06
Pranayama		
26	Ujjayi	-0.33
27	Shitali	-0.06
28	Sheetkari	0.0
Relaxation Technique		
29	Yoga Nidra	0.13
Meditation		
30	OM meditation	0.06
Kriya		
31	Jal Neti	0.0
32	Sutra Neti	-0.4
33	Vaman Dhauti	0.06
34	Nauli	-0.06

Discussion

In the present study, an attempt has been made to develop an IYM for volleyball players by selecting specific yoga practices including loosening practices, breathing practices, yoga postures, and yoga-based relaxation and meditation techniques, from classical yoga texts and scientific studies on yoga. However, to date, no previous studies have focused on the validation of IYM for sport of Volleyball.

This study was planned in two phases: (a) designing of IYM for volleyball players (b) validation of IYM for volleyball players by SMEs. Thirty Subject matter (yoga) experts (SMEs) from Lakulish Yoga University (LYU) and Swami Vivekananda Yoga Anusandhana Samsthana (SVYASA) who fulfilled the study criteria, were involved in the validation process. Total 77 yoga practices were subjected to validation and content validation ratio was calculated for all by Lawshe's formula. Out of 77 practices, 43 practices achieved CVR above and equal to 0.33. These yoga practices were included in the validated yoga module. Thus, the final CVR satisfied the minimum value, as per Lawshe's CVR.

An ideal yoga module, like any other exercise protocol, consists of modes, frequencies, intensities, durations, and progression. Determining a suitable mode depends on athlete's preference. The frequency, intensity, and duration are specific to the type of activity and should be designed for the athlete's ability to perform the activity safely.

In this study, integrated yoga module comprises of various yoga exercises all benefits athletes physically and psychologically. Yoga is a voluntary and mindful technique that positively affects the person physically and mentally. Shithilikarna vyayama (Loosening exercise) is performed normally with speed and repetition. This Loosen the various joints and remove lethargy and slowness, develop the stamina (Nagarathna & Nagendra, 2008) [22]. Sukshma vyayama removes the blocks in the muscles and strengthens them, improve body mobility and makes it flexible, develops balance and coordination in the body and increases the vital lung capacity and volume (Madankumar, 2018) [17]. Breathing practices develops awareness of breathing through the movements of different parts of the body. It normalizes the breathing rate and makes the breathing uniform, continuous and rhythmic (Nagarathna & Nagendra, 2008) [22].

Suryanamaskar combines yogasanas and pranayama, which bring flexibility and prepare the body for asanas and pranayama. Each round of Suryanamaskar is comprised of 12 steps is accompanied by regulation of breathing (Nagarathna & Nagendra, 2008) [22]. Suryanamaskar has positive physiological benefits, as evidenced, it improved pulmonary function, respiratory pressure, hand grip strength and endurance, and resting cardiovascular parameters (Bhavnani *et al.*, 2011).

There are generally two types of yogasanas, dynamic and static. Dynamic postures are activating motion with movement and repetition. It stimulates the nervous and glandular systems resulting in the release of energy. Static postures are movements without jerks and easy maintenance that improve strength and flexibility. Each has specific benefits with regard to neuromuscular rehabilitation (Nagarathna & Nagendra, 2008) [22].

Pranayama improves the ventilatory function of the lungs by utilizing the full capacity of the lungs, reducing oxygen debt, improving gaseous exchange and preventing

exhaustion. Bhramari Pranayama stimulates the reflexes of the autonomic nervous system, which changes the level of noradrenaline. Noradrenalin is a hormone and neurotransmitter in the nervous system that helps to reduce the levels of neuro-hormones responsible for various stresses, anxiety and agitated mental states through bio-feedback mechanisms (Srivastava, 2017) [36]. Bhastrika pranayama significantly reduces levels of anxiety and distress, and these changes are associated with modulation of activity and connectivity in brain regions involved in emotion processing, attention and awareness (Novaes *et al.*, 2020) [24]. Nadi Shodhana pranayama lowers blood sugar levels, heart rate and blood pressure by activating the parasympathetic nervous system which promotes healthy cardiovascular functioning of the body, controls high blood sugar by stimulating insulin secretion from the pancreas (Tripathi & Sahu, 2019).

Yoga Kriya is a special technique of purifying internal organs, which stimulates the body and develops inner awareness. Trataka is effortless gazing at a particular point. It cleanses the tear glands and purifies the optical system, balances the nervous system, alleviates anxiety, depression and insomnia (Nagarathna & Nagendra, 2008) [22]. Kapalbhathi is a passive inhalation and forceful exhalation. The practice of Kapalbhathi results in removal of carbon dioxide and oxygen build-up in the peripheral tissues of the brain, the greater supply of oxygen leading to optimal metabolism in the forebrain (Patra, 2017) [25].

In summary, an IYM for volleyball players which was developed based on traditional texts, and previous research publications and validated with the help of qualified experts met the study criteria. The findings support a case for testing this module for feasibility and upcoming trials for volleyball players.

Conclusion

The Integrated Yoga module comprised 77 practices for volleyball players and was validated by 30 yoga experts. This showed that, out of 77 practices, 43 were found to be essential (CVR \geq 0.33) and 34 were not found to be essential (CVR < 33). Based on the findings of this study, the Integrated Yoga Module for the game of volleyball suggests good content validity.

This integrated yoga module is a valid module for volleyball athlete. However, the feasibility and efficiency of the integrated yoga module must be determined by future studies.

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Strength and Limitations

Aim of the study was to develop and validate integrated yoga module for volleyball players and to date no study that has been conducted to develop and validate an integrated yoga module for the volleyball players. Additionally, all the panelists of SMEs were from different schools of Yoga (Lakulish Yoga University, Ahmedabad, Gujarat, India and S-VYASA, Bangalore, Karnataka, India).

Integrated Yoga Module is comprised of various yogic practices but impact of each practice can be explained by when it will be implemented on players. For that, further study is needed on feasibility test on yoga module for volleyball players.

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Disclosure Statement

The authors report no conflict of interest.

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