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Vidhi Patel
Research Scholar, MSC (Yoga), Department of Astanga Yoga Lakulish Yoga University Chharodi, Ahmedabad, Gujarat, India

Dr. Vijayakumar PS
Associate Professor, BAMS, MD (Yoga & Rehab.), Msc (PSY), Department of Astanga Yoga Lakulish Yoga University Chharodi, Ahmedabad, Gujarat, India

Sahana AU
Clinical Psychologist, MSC (Clinical Psychology), Department of Astanga Yoga Lakulish Yoga University Chharodi, Ahmedabad, Gujarat, India

Corresponding Author:
Vidhi Patel
Research Scholar, MSC (Yoga), Department of Astanga Yoga Lakulish Yoga University Chharodi, Ahmedabad, Gujarat, India

To develop and validate an integrated yoga module for the sport of cricket

Vidhi Patel, Dr. Vijayakumar PS and Sahana AU

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Abstract
Background: Cricket is one such sport that tests the sport abilities, mental strength, stamina and physical endurance as well to attain their personal best, they have to play the maximum amount attention to fitness as they are doing to the perfection of batting, bowling and fielding skills. Yoga incorporates a great sense of sports community hooked up to it. Adopting yoga as a holistic mind-body intervention fosters the development of many personal, sport and performance-relevant physical, physiological and psychological skills.
Materials and Methods: First phase- IYM for sport of cricket was designed based on the literature review of classical texts and research articles. Second phase – Designed IYM was validated by 31 subject matter (yoga) experts. Content-validity ratio (CVR) was analysed using Lawshe's formula.
Results: Yoga practices were designed for Integrated Yoga Module for Sport of Cricket. Yoga practices with CVR ≥0.355 and which were validated by 31 yoga experts were included in final Integrated Yoga Module.
Conclusion: Previous research studies on yoga, sports, cricket and other related researches helped in formulating yoga module for the sport of cricket. However, till date there is no former attempt has been made to validate an integrated yoga module for sport of cricket, which can be used as cross-training. Therefore, this study has been carried out to design and validate IYM for Sport of Cricket. Result shows that among the 74 practices, 46 found to be essential (CVR ≥ 0.355) for sport of cricket. This integrated yoga module is a valid module for Cricket players.

Keywords: yoga, cricket, integrated yoga module, physical and psychological effects

Introduction
Internationally, 3 formats of cricket are vie at the elite level: test Match, one day and Twenty20. The test matches length has been 5 days and a minimum of six hours per day wherever restricted over means that one day matches seven hours and Twenty20 matches three hours. The sport of cricket is an extremely technical and skilled game that is played by two teams, each team consisting eleven players, on an oval field. The best challenge concerning cricket is that it consists of four distinct disciplines all requiring specialised skills which incorporates batting, bowling, fielding and wicket keeping (Webster & Travill, 2018) [31]. Previously, cricket has been understood as a game that needs a low level of physical fitness alongside least physical requirements (Christie *et al*., 2008) [5]. Recent research, has shown that the demands have increased, because of the various formats and also the different demands for the distinctive disciplines. The demands of the sport are compact by duration and intensity of effort, thus different distances are coated at varying intensities depending on the activity required of every position. The energy system is an anaerobic most of the time in the game cricket for the players but because it is a long duration game aerobic capacity also a very important factor for the best physical fitness performance of the cricketers (Hoque, 2018) [11]. Cricket players need a high level of aerobic fitness in order to play for up to six to eight hours per day, with intermittent, short bursts of high-intensity effort that needs contribution from the anaerobic energy system.
The skill of batting in cricket is a complex combination of mental, physical, perceptual, technical and tactical proficiency (Weissensteiner *et al*., 2008) [32].

Duffield & Drinkwater (2008) [8] conducted a time-motion analysis of Test and One Day Game (international) cricket centuries and found that when scoring a one-day century batsmen spend a large amount of time in low-intensity modes of standing, walking, and to a reduced extent jogging. The batsman spends approximately 63% of the time above 75% of their maximum heart rate (HRmax) during their batting innings (Christie *et al*., 2020) [4]. It is believed that no other form of the game tests an individual's technique and mind as thoroughly as multiple-day cricket (Woolmer *et al*., 2008) [33].

In high scoring contexts such as limited-overs cricket that are one-day and more in Twenty20 cricket, abundant pressure is placed on bowlers to find good length and forestall batsmen from getting under the ball. A fast bowler's run-up consists of a longer length and a flat-out sprint, whereas a spin bowler's run-up entails a couple of short strides (Jooste *et al*., 2013) [12]. Fast bowlers have a high physical and biomechanical demand due to the complexness of the bowling action and high ground contact velocity forces throughout the landing action. Spin bowlers don't cover as much distance (Webster & Travill, 2018; Sholto-Douglas *et al*., 2020; christie *et al*., 2008) [31, 26, 5] due to differences in run-up length and because they need more fine motor skills compared to fast bowlers who use more gross motor skills. Recent times have demanded cricketers to be as masterly within their fielding as in their bowling or batting. Throughout a T20 match, fielders ought to stay centred for a period of 90 min and through a 1-day match for up to 5 h (MacDonald *et al*., 2013) [14]. However, high-intensity efforts during a T20 are highest and quite double than that of each test matches and 1-day matches. This means that the length of the match doesn't have an effect on the distance, however it will be affect the intensity of effort by the fielders as a lot of work is entailed during a shorter span of time (Webster & Travill, 2018; Petersen *et al*., 2010; Sholto-Douglas *et al*., 2020) [31, 18, 26].

Wicket keeping is one of the foremost tough specialty positions in cricket and needs vast skill, stamina and concentration. A wicketkeeper has to maintain full concentration and is expected to receive the ball every single time it's bowled (Dhillon *et al*., 2013) [7]. It is therefore absolutely essential that a wicketkeeper has an excellent basic catching technique, maintains absolute alertness, and has swift and fast diving skills to provide the most effective performance (Dhillon *et al*., 2013) [7]. High levels of fitness and suppleness also are preponderating to wicketkeepers since they're required to squat effectively and dive many times around the wickets during a single innings (Jooste *et al*., 2013) [12]. The most important challenge to a cricketer isn't the learning of the skills because most players have affordable techniques, usually the biggest challenge for players is having the ability to cope with the numerous psychological factors that may affect thinking and ultimately performance throughout a game (Cotterill & Barker, 2013) [6]. Cricket requires immoderate physical skill and mental aptitude, as well as the ability to concentrate intensely for terribly long periods, that a high level of physical fitness cannot totally compensate (Noakes & Durandt, 2000) [17].

Overusing some muscles whereas under exploitation others creates muscular imbalances, that affect the complete musculoskeletal balance and impairs biomechanical efficiency. For mostly sports persons, biomechanical imbalances eventually result in pain and injury (Poonam, 2017) [19]. It's contended that this continual eccentric loading of the lower limb muscle system is the real source of stress for cricket players (Noakes & Durandt, 2000) [17] and which might replicate more in lower limb muscle sprains and strains. Researchers found that of all age groups, the upper (36%) and lower (31%) limbs were most typically injured (Bartlett, 2003).

Yoga for Sport of Cricket

Yoga involves using ancient techniques combined with a scientific approach of sports training to move one's body, to improve one's strength, stability and flexibility, and to reduce the risk of injury thereby ensuring a prolonged career (Maurya & Kumar, 2015) [15]. A systematic research reviews on yoga shows that yoga Strengthens deep connective tissue preventing or minimizing injury, creates an overall body flexibility, increases range of motion and mobility. Dramatically enhances physical balance by developing the athlete's awareness of his body's centre place, thus keeping their body balanced in action, moment by moment, giving the ability to recover from or prevent falls, while enhancing agility and manoeuvrability. Improves circulation, massages internal organs and glands for optimum health. The yoga breath circulates and detoxifies the Lymph Fluid to speed up recovery time from training 15% faster, eliminating fatigue (Saini & Lahange, 2017) [24]. Every yoga pose is a balance of stability (muscles contracting and strengthening) and mobility (muscles stretching and lengthening) (Poonam, 2017) [19]. A balanced yoga practice requires most of the muscles in the body to perform some action. At the same time, joints are taken through their full ranges of motion as the corresponding muscles contract or stretch to support the movement. The result is improved muscle balance, which translates to better form, stronger running, and fewer injuries (Poonam, 2017) [19]. In yoga, flexibility exercises involve loose and relaxed muscles, relieving muscle tension and soreness while increasing range of motion and agility (Ryba, 2006) [23]. Yoga group were able to maintain for a relative long period very strenuous positions requiring a high degree of muscle control and balance, with low energy expenditure and cardiopulmonary effort (Ce *et al*., 2015) [3]. Asana involve isometric contraction which is known to increase skeletal muscle strength (Nambinarayanan *et al*., 1992) [16]. Increase in muscular endurance and delay in onset of fatigue (Ray *et al*., 1986) [21]. Conversion of some of the Fast Twitch muscle fibres into Slow Twitch muscle fibres during yogic training. Slow twitch fibres have high aerobic power (Balasubramanian & Pansare, 1991). A feeling of lightness comes with regular Yoga practice. Hand-eye coordination improves greatly, and reflexes become sharper. Quicksilver reflexes are a boon when it comes to fielding in positions close to the bat (Maurya & Kumar, 2015) [15]. Quicksilver reflexes are a boon when it comes to fielding in positions close to the bat (Maurya & Kumar, 2015) [15]. Back bends energizes the spine and help generate short bursts of speed when needed. This is of relevance for batsmen who need to take quick runs (Maurya & Kumar, 2015) [15]. Twists open up the range and scope of spinal movements. This is important for the wicket keeper and bowler. They both have to dive often in the football goalkeeper fashion. So, both keeper and bowler would do well to practice all types of asanas to keep the joints fine and strong (Maurya & Kumar, 2015) [15]. Standing poses provide elasticity to the hamstring muscles and help to maintain the knee and ankle joints in prime condition.

Regular yoga practice increases oxygen consumption by the muscles which increases muscle blood flow due to a generalized decrease in vascular tone resulting from stimulation of parasympathetic activity during Yogic Training

(Balasubramanian & Pansare, 1991) [1]. Some results are supported by a randomized crossover trial documenting reduction in blood lactate, heart rate, and blood pressure with regular yoga practice (US Ray *et al*., 2001) [29]. During the yogic practice the rise in carbon dioxide output (VCO2) was comparatively lower than the corresponding Oxygen consumption (VO2) as it happens in conventional dynamic exercises at sub-maximal level. , pulmonary ventilation (VE) and carbon dioxide output (VCO2) increased proportionately with the increase in oxygen consumption (VO2) in all the yoga asana (Ray *et al*., 2011) [22]. A close look into the pattern of changes in ventilatory equivalent of oxygen (EQO2) and ventilatory equivalent of carbon dioxide (EQCO2) in different asana reveals that in most of the cases while practicing yoga-asana, the exercise is well within lactate threshold (Ray *et al*., 2011) [22]. According to the findings of this study, it may be concluded that yoga may up regulate the antioxidant capacity of cells to combat oxidative stress (Sinha *et al*., 2007) [27]. Concentrations of human beta-defensin 2 (HBD2), an enzyme which is predictive of mucosal immune function, are more elevated after an acute bout of yoga than of passive rest.

The key component seems to be yoga's potential to help athletes become more attuned to their bodily processes, needs, and signals and thus be able to recognize minor symptoms before they become major ones (Ryba, 2006) [23]. Defensins possess antibacterial, antifungal, and antivirus properties; therefore increases can lead to an increase in immune function which is beneficial in keeping athletes healthy, and specifically combats symptoms of overtraining (Eda *et al*., 2013) [9]. Yoga intervention in athlete decreases noradrenaline, decreases salivary cortisol, improves immune response through CS8+T cells, attenuates of exercise-induced inflammation, and reduces recovery time from injury (Bühlmayer *et al*., 2017; Sanada *et al*., 2016) [2, 25].

Yoga down regulate the hypothalamic–pituitary–adrenal axis and the sympathetic activity and therefore promote relaxation and stress relief (Tyagi *et al*., 2013) [28]. The purifying action of hath yogic practices on the brain cells enhances the capacity of the brain centres, allowing them to function at their optimum capacity (Verma *et al*., 2016) [30]. Long-term yoga practice is associated with less serum IL-6 production in response to stressors so yoga is a healthy coping mechanism for stress (Kiecolt-Glaser *et al*., 2010) [13]. Adopting yoga as a holistic mind-body intervention fosters the development of several personal, sport and performance-relevant psychological skills where goal-oriented behaviour and automatic goal-focused processes are facilitated (Harinath *et al*., 2004) [10]. Yoga can help to boost their confidence. After the practicing of yoga, cricketers who play for six hour long duration of game can feel more grounded, less self-absorbed and more peaceful. They can understand that how their conscious and subconscious mind affects their body (Maurya & Kumar, 2015) [15]. Integrating ancient wisdom of yoga into the competitive world of cricket appears to be promising as a holistic approach in enhancing mindfulness (Rao *et al*., 2020) [20].

Validation

Data was analyzed using the statistical test Lawshe's Content Validity Ratio (CVR) to check the content validity (LAWSHE, 1975). There have been several studies which suggests yoga for improvement of cricketer's overall wellbeing but there are no particular studies that have been done to develop and validate proper yoga module for cricket players. Hence, the present study for validation was planned and implemented.

Materials and Methods

The design, validation, and data analysis of Integrated Yoga Module (IYM) for sport of Cricket were carried out in the following steps: Figure 1.

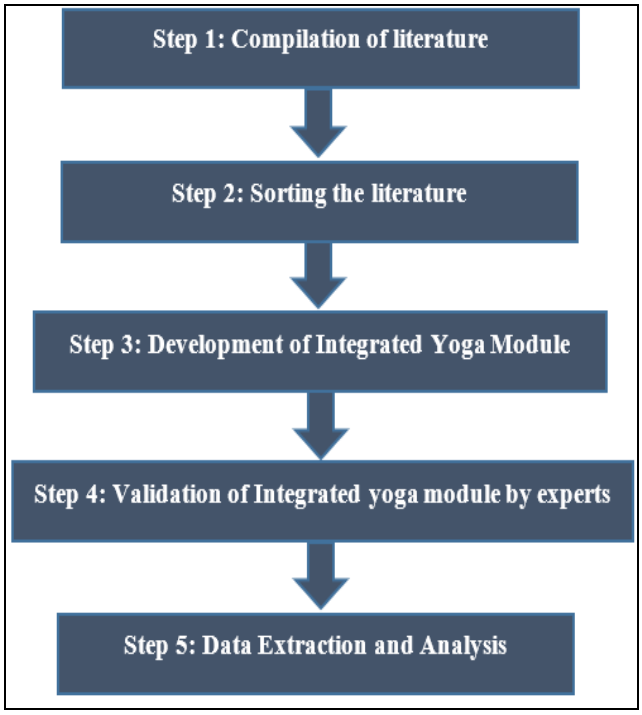

Fig 1: Flowchart of steps in the development of IYM.

Step 1: Compilation of literature

- Classical and contemporary yoga texts on hatha yoga and ashtanga yoga, such as Hathayoga Pradeepika by Swami Swatmaram, Gheranda Samhita, and Yoga Sutra by Maharshi Patanjali were reviewed for ancient literature on yoga practices.
- Research studies, publications, thesis/ dissertation, books and other related sources on physiological demands of cricket athletes and physical profile of cricket players were identified using different search engines such as PubMed, Research gate, and Google Scholar, indexing terms such as "cricket athletes", "physical requirement of cricket", "physiological demands in cricket", "psychological requirement of cricket", "physical requirement of batsman", "musculoskeletal requirement of bowler", "requirements for wicket-keeper".
- Research studies, publications, thesis/ dissertation, books and other related sources on common injuries of cricket players were identified using different search engines such as PubMed, Research gate, and Google Scholar, indexing terms such as "cricket players", "injuries in cricket", "sports injury".
- Research studies, publications, thesis/ dissertation, books and other related sources on yoga for sports and cricket players were identified using different search engines such as PubMed, Research gate, and Google Scholar, indexing terms such as "yoga for athletes", "yoga for sports", "yoga and flexibility", "yoga and strength, endurance", "yoga in cricket", "yoga for athlete".

Step 2: Sorting the literature

The compiled literature was searched to identify the common and unique features described in each study. Studies published in scientific journals were extracted, which provided scientific support to the literary search.

Step 3: Development of Integrated yoga module

A customized protocol was developed, which comprised yoga practices supported by the classical texts and research evidence. This preliminary yoga module comprised 74 yoga practices.

Step 4: Validation of the Integrated yoga module by experts

For validation, the complete module was presented to subject matter experts (SMEs), with clinical experience [who have either a doctorate or Doctor of Medicine degree in Yoga, with a minimum of 5 years' experience or a degree in yoga (MSc Yoga)/yoga therapist, with a minimum of 7 years' experience]. These experts were requested to validate the practices in the proposed module on a three-point scale as follows.

1. Not essential – indicates that no role in improving athletic performance
2. Useful but not essential - useful in improving general wellbeing, but the benefits are not specific to cricket athlete's physiological needs
3. Essential - very useful for the cricket athletes

A panel comprising 31 experts with the mentioned qualifications was assembled for determining the content validity. Experts in yoga therapy with clinical experience (≥5 years), also be considered as yoga experts.

For calculating the content validity ratio (CVR), the expert panel was asked to comment on the necessity of the included items.

Step 5: Data Extraction and Analysis

A matrix of the validated results by 31 experts was prepared. Data was analyzed using the statistical test Lawshe's Content Validity Ratio (CVR) to check the content validity (LAWSHE, 1975).

Each expert was asked to rate the content validity of each domain on a three point scale: "Essential", "useful but not essential", "Not necessary". The content validity was then calculated using the method of LAWSHE (1975), If E denotes the number of experts marking a domain as essential and N the total number of experts, then LAWSHE's CVR is defined as the ratio of (E - N/2) and N/2. The critical values for this CVR statistic are given in LAWSHE (1975).

One widely used method of measuring content validity was developed by C.H. LAWSHE. It is essentially a method for gauging agreement among raters or judges regarding how essential a particular item is. LAWSHE (1975) proposed that each of the subject matter expert raters (SMEs) on the judging panel respond to the following question for each item: "Is the skill or knowledge measured by this item 'essential,' 'useful, but not essential,' or 'not necessary' to the performance of the construct?"

According to Lawshe, if more than half the panelists indicate that an item is essential, that item has at least some content validity. Greater levels of content validity exist as larger numbers of panelists agree that a particular item is essential. Using these assumptions, Lawshe developed a formula termed the content validity ratio: using content validity ratio, number of SME panelists indicating "essential", total number of SME panelists.

This formula yields values which range +1 to -1: positive values indicate that at least half the SMEs rated the item as essential The mean CVR across items may be used as an indicator of overall test content validity.

Lawshe's Formula: $CVR = \frac{N_e - \left(\frac{N}{2}\right)}{\frac{N}{2}}$

Where

Ne = total number of panelists indicating "essential" for each practice

N = total number of panellists

Results

It has been found that out of 74 IYM practices selected for validation, 46 practices achieved CVR value equal or above the critical value (≥ 0.355), indicating high content validity. These practices are considered to be "essential" for Cricketers (Table 1). Other practices (Table 2) achieved CVR value below 0.355 (<0.355), indicating low content validity and these practices were used as complimentary poses for important postures to align the body and mind.

Table 1: Shows yoga practices with CVR score 0.355 and above (≥0.355).

No.	Practice List	CVR
1	Jogging (Slow, Forward, Backward, Side Wise)	0.871
2	Forward and Backward Bending	0.935
3	Side Bending	0.742
4	Pawanmuktasana Kriya	0.613
5	Twisting	1
6	Greevasanchalana (Neck Movements)	0.677
7	Janusanchalana (Knee Movements)	0.613
8	Katisanchalana (Waist Movements)	0.548
9	Padasanchalana (Ankle Movements)	0.742
10	Scandasanchalan (Shoulder Movements)	0.742
11	Hands in & out breathing	0.613
12	Hands Stretch Breathing	0.677
13	Ankle Stretch Breathing	0.871
14	Tiger Breathing	0.484
15	Straight leg Raise Breathing	0.806
16	Suryanamaskar (19 Dynamic & 1 Slow)	0.742
17	Bhujangasana	0.548
18	Bhunamanasana	0.419
19	Chakrasana	0.484
20	Dhanurasana	0.484
21	Halasana	0.419
22	Makrasana	0.419
23	Naukasana	0.742
24	Navasana	0.613
25	Padahastasana	0.871
26	Parivritta Trikonasana	0.677
27	Paschimottanasana	0.935
28	Pawanamuktasana	0.548
29	Sarvangasana	0.484
30	Setubandhasana	0.419
31	Shalabhasana	0.677
32	Shasankasana	0.484
33	Shavasana	0.677
34	Trikonasana	0.742
35	Ushtrasana	0.484
36	Vrikshasana	0.355
37	Bhastrika	0.613
38	Bhramari	0.742
39	Nadishuddhi Pranayama	0.677
40	IRT	0.548
41	QRT	0.613
42	DRT	0.871
43	Cyclic Meditation	0.677
44	Yoga Nidra	0.613
45	Kapalbhati	0.677
46	Tratak	0.742

Discussion

In the current study, efforts have been made to develop a valid integrated yoga module for sport of cricket by selecting specific yoga practices from traditional texts and research studies, loosening exercises, breathing exercises, yoga postures, and yoga-based relaxation practices and meditation techniques, from classical yoga texts. In addition, previous findings in their research studies on yoga, sports, cricket and other related studies helped in formulating yoga module for the sport of cricket. However, till date there is no previous attempt has been made to validate an integrated yoga module for sport of cricket, which can be used as cross-training.

This study was conducted in two phases: (a) developing the yoga module for sport of cricket and (b) experts' validation of the module for sport of cricket. Thirty-one qualified yoga experts from Swami Vivekananda Yoga Anusandhana Samsthana (SVYASA), Bangalore and Lakulish Yoga University (LYU), Ahmedabad, who fulfilled the study criteria, participated and contributed in the current study by providing deeper insight with their expertise and experience, into the validation phase of IYM (Integrated Yoga Module). A list of 74 yoga practices were subjected to validation under the criteria of Lawshe's formula for CVR with critical value for CVR (CVR critical) computed to be equal or above 0.355 (≥ 0.355) for all the 74 items. It has been found that out of 74 IYM practices selected for validation, 46 practices (Table 1) achieved CVR equal or above the critical value (≥ 0.355), indicating high content validity and were included in the final validated yoga module. The remaining 28 practices (Table 2) below the critical value (0.355) will use as a complimentary practices. According to experts these practices are not that much relevant for the cricket players.

Table 2: Shows yoga practices with CVR score below 0.355 (<0.355).

No.	Practice List	CVR
1	Dog Breathing	0.032
2	Rabbit Breathing	-0.097
3	Shasankasana Breathing	0.032
4	Ardha kati Chakrasana	0.161
5	Ardha/poorna Matsyendrasana	0.226
6	Bakasana	0.097
7	Bhadrasana	0.097
8	Dandasana	0.226
9	Hanumanasana	0.032
10	Koormasana	-0.161
11	Marjariasana	0.032
12	Matsyasana	-0.161
13	Mayurasana	0.161
14	Supta vajrasana	0.226
15	Tadasana	0.226
16	Tuladharasana	-0.226
17	Utkatasana	0.161
18	Utthana Koormasana	-0.355
19	Utthanpadasana	0.226
20	Veerabhadrasana	0.226
21	Sheetkari	-0.032
22	Shitali	-0.097
23	Ujjayi	0.097
24	Om Meditation	0.226
25	Jal Neti	0.226
26	Nauli	-0.29
27	Sutra Neti	-0.548
28	Vaman Dhauti	0.032

However, the 46 practices (CVR≥0.355) in (Table 1) were considered essential for Sport of Cricket; Thus, the final CVR of IYM satisfied the minimum value, as per Lawshe's CVR.

Like any other exercise protocol, an ideal yoga intervention consists of modes (types), frequencies, intensities, durations, and progression. Determining the appropriate mode depends upon the athlete preference. The frequency, intensity, and duration are specific to the type of activity and should be tailored according to the athlete's ability to safely perform the activity. In summary, an IYM for sport of cricket has been developed based on traditional texts, and previous research publications and validated from the qualified experts, who satisfied the study criteria. However, the module remains to be tested for feasibility.

Conclusion

Integrated Yoga Module consists of 74 practices for sport of cricket and this was validated by 31 yoga experts. (Table 1 & Table 2) showed that, among the 74 practices, 46 found to be essential (CVR ≥ 0.355) and 28 found to be not essential (CVR< 0.355). Based on the findings from this study, the Integrated Yoga Module for Sport of Cricket suggests good content validity. This integrated yoga module is a valid module for Cricket players. However, the feasibility and effectiveness of the Integrated Yoga Module must be determined by future studies.

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