Development and Validation of a *Yoga* Module for Adolescents with Type 1 Diabetes

By Sonu Maurya, Dr. Itagi Ravi Kumar, Dr. Amit Singh & Dr. R. Nagaratna

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i. Not essential,
ii. Useful but not essential,
iii. Essential.

Lawshe’s formula is adopted to arrive at the content validity ratio (CVR) after obtaining the ratings.

Result: Data analysis revealed that out of the 41 JYM practices, 27 JYM exhibited significant content validity (cut-off value: 0.49, as calculated by applying Lawshe’s formula for the CVR).

Conclusion: The present study suggested that the JYM for adolescents with T1D is valid with good content validity. However, future studies must determine the feasibility and efficacy of the developed JYM module for adolescents with T1D.

Keywords: autoimmune disorder, type 1 diabetes, yoga and diabetes, yoga, adolescents.

I. Introduction

Most adolescent patients with type 1 diabetes (T1D) do not meet treatment goals, which increases their risk for diabetes-related complications; therefore, finding ways to improve adherence to therapy is crucial (Patel et al., 2018). Type 1 diabetes (T1D) develops in genetically predisposed people as a result of the destruction of the pancreatic beta cells caused by an autoimmune insulinitis (Briscoe et al., 2007; Sharma, 2017). Increased thirst, frequent urination, bed-wetting in children and adolescents who previously didn't wet the bed during the night, extreme hunger, unintended weight loss, irritability and other mood changes, fatigue, and weakness, blurred vision are some major symptoms (Fowler, 2008; Kalra et al., 2013).

Adolescents experience significant physiological and psychosocial changes during this developmental stage, including increased insulin resistance related to pubertal hormones, significant weight gain, higher insulin needs, and independence from parents. Unfortunately, this newfound autonomy often results in problems with T1D. It may further exacerbate poor glycemic control. Besides, adolescents with chronic hyperglycemic conditions may be more likely to engage in high-risk behaviors, such as drug and alcohol use, cigarette smoking, etc. (Comeaux, 2010; Patel et al., 2018; Weitzman et al., 2015).

Yoga is a mind-body intervention and comprises physical practice (āsana), breathing technique (praāāyāma), and meditation, and relaxation techniques. Yoga is a popular complementary and alternative medicine modality worldwide (Falkenberg et al., 2018).

Many studies have reported several health benefits of yoga for a clinical condition such as asthma, diabetes, pulmonary tuberculosis, epilepsy, fibromyalgia, and arthritis (Cramer, 2015; Gowtham, 2018; Hongasandra, 2017; Lin Yin et al., 2011; Nagothu, 2015; Patil, 2019; Ross & Thomas, 2010; Shantakumari et al., 2013; Vijayakumar, 2018; Vinutha et al., 2015; Zivdar, 2014), and consistent effects especially on circulating inflammatory markers (Falkenberg et al., 2018), improvements in physical fitness, immune activity (Kosuri & Sridhar, 2009), improved beta-cell function (Raj, 2016), and reduced stress as physiological mechanisms for beneficial effects of yoga on the immune system in adolescents (Sahay, 2007; Mohan et al., 2005; Szablewski, 2014).

II. Quality of Life and Type 1 Diabetes

Children with type 1 diabetes mellitus (T1DM) have to deal with a complex and demanding daily treatment regime, which can harm the quality of life (QoL) of these patients (Rasoul et al., 2013). Although children and adolescents with T1DM have to live with a demanding treatment regime, overall results revealed that their generic QoL is not impaired compared to healthy peers (Duru et al., 2015). Young adults with Type 1 diabetes mellitus are a high-risk group with suboptimal glycemic outcomes when compared with older adults with Type 1 diabetes (Ambler et al., 2006). Management
is challenging because of psychosocial issues; for example, body image perceptions (Neumark et al., 2002), the increased incidence of psychiatric illness (Bernstein et al., 2013), eating disordered (Quick et al., 2012), and impaired quality of life (Kibbey et al., 2013; Ingerski et al., 2010). Some studies suggest that low glycemic variability may be associated with lower quality of life, negative moods, blood glucose fluctuations (Penckofer et al., 2012). A meta-analysis of 27 studies demonstrated that depression is majorly associated with hyperglycemia for type 1 diabetes (Lustman et al., 2000). Moods such as anxiety and anger often accompany depression with type 1 diabetes (Peyrot & Rubin, 1997); anxiety is associated with poor glycemic control (Anderson et al., 2002). Anger is also linked to depression (Pas Quinn et al., 2004). It is associated with glucose fluctuation and poorer self-management of hyperglycemia for persons with type 1 diabetes.

For persons with type 1 diabetes, high glucose values suggest to impact mood negatively, positive mood rating decreased, whereas negative mood ratings increased, tension and anger is reported to be higher in type 1 diabetes individuals in the hyperglycemic range compared with those in the hypoglycemic range with continuous glucose monitoring (CGM) (Hermanns et al., 2007). However, glycated hemoglobin (HbA1c) has been the standard for assessing glycemic control, glycemic variability (Hirsch, 2005).

### III. YOGA AND IMMUNE SYSTEM

Yoga is an ancient mind-body practice that is increasingly recognized to have health benefits in a variety of clinical and non-clinical conditions (Falkenberg et al., 2018). Among various types of yoga, emphasizing both physical and mental training, and typically consists of yoga poses, breathing, and meditation (Nagendra, 2003). It is stated that yoga not only increased physical endurance but also reduced pro-inflammatory markers such as interferon γ (INF-γ), interleukin-6 (IL-6), interleukin-2 (IL-2), and stress level (Pullen et al., 2008). Based on these results, yoga practice is required to achieve consistent effects, especially on circulating inflammatory markers (Falkenberg et al., 2018), improvements in physical fitness, immune activity (Kosuri & Sridhar, 2009), improved beta-cell function (Raj, 2016), and reduced stress as a physiological mechanism for beneficial effects of yoga on the immune system (Sahay, 2007; Mohan et al., 2005; Szablewski, 2014). The practice of yoga reduced inflammation and smaller autonomic, endocrine, and inflammatory response to the stressors and novices. The yoga practice demonstrated more rapid declines (recovery) in stress hormone and proinflammatory cytokines production and better glycemic control in T1D (Sreereevi, 2017). Yoga is a cost-effective option in the treatment and prevention of autoimmune disorder, with data from several studies suggesting that yoga and other mind-body therapies can reduce stress-related hyperglycemia and have a positive effect on glycemic control, balancing harmonizing the body, mind, and emotions. Increasing evidence suggests that yoga practice tackles the pro-inflammatory mechanisms of T1D and helps in controlling autoimmune disorders (Amita et al., 2009; Author, 2019; Dubey et al., 2014; Sharma et al., 2013, 2014).

Previous studies on yoga, physical activity (Chimen et al., 2012; De Lima et al., 2017), and exercise (Herbst et al., 2006; Reddy et al., 2018) have demonstrated that these practices changed glycaemic variation, improved mental health and quality of life (QoL) in autoimmune diseases (Falkenberg et al., 2018).

#### a) Materials and methods

The content validity of JYM for adolescents with T1D is assessed by a panel of 20 experienced yoga experts. The JYM for children and adolescents with T1D is developed in the form of tailor-made yoga practices that are supported by classical texts and research evidence.

All the 41 practices in the JYM, is discussed and rated as

i. Not essential,
ii. Useful but not essential,
iii. Essential.

Lawshe’s formula is adopted to arrive at the content validity ratio (CVR) after obtaining the ratings.
Step 1: Compilation of literature on yoga and diabetes
a. In this phase, we reviewed traditional and contemporary yoga texts.

b. Research paper on the use of yoga in diabetes, immune and metabolic disorders, including modern scientific reviews of T1D, were identified using different search engines such as Pub Med and Google Scholar. Indexing terms such as yoga immune disorder, metabolic disorder, and yoga, and diabetes. All experimental studies that used yoga as the therapy for diabetes are included.

Step 2: Shorting the literature on yoga and diabetes
A summary of the literature is tabulated for a quick overview. Then, studies done on different practices and published in journals as a scientific background is extracted.

Step 3: Preparing yoga module based on previous literature on yoga and diabetes
Based on classical texts and research evidence a detailed protocol with tailor-made practices is developed.

Step 4: Validation of JYM by expert
Yoga experts with clinical experience are provided with this complete module (who had either a doctorate or Doctor of medicine degree in yoga, with a minimum of 5 years experience or a Master’s degree in yoga/yoga therapist, with a minimum of 7 years experience). These experts were requested to participate in evaluating the content validity for the proposed instrument on a 3-point scale rated as follows: (i) not essential (has no role in improving any symptoms or the quality of life of patients with T1D), (ii) useful but not essential (useful in improving general wellbeing, but the benefits are not specific to T1D symptoms), and (iii) essential (very effective for T1D).

An expert panel, including 20 experts with the above qualifications, involved for determining the content validity. Experts in yoga therapy with clinical experience (≥5 years) were also considered yoga experts. Among the 20 experts, more than ten has previously applied yoga therapy in patients with diabetes and were already using most of the practice included in this module.

The CVR for the total scale was computed based on expert validation. According to Lawshe’s formula, if more than half of the panelists indicate that an item is essential, then that item has the minimum content validity. The CVR for our scale was ≥0.49, which was considered satisfactory for a panel of 20 experts.

b) Statistical Analysis
The cut-off value of 0.49 is calculated by applying Lawshe’s formula for CVR (Lawshe, 1975). The mean CVR across the item indicated the overall test content validity.

\[ CVR = \frac{N_e - N/2}{N/2} \]

Where,
Ne = total number of panelists indicating “essential” for each practice.
N = total number of panelist

IV. Result
The data analysis showed that out of 41 JYM practices, 27 indicated significant content validity in (Table 1). 14 practice (Table 2) had a CVR score of below 0.49, indicating low content validity.

<table>
<thead>
<tr>
<th>SL. no.</th>
<th>Practice Name</th>
<th>CVR</th>
<th>SL. no.</th>
<th>Practice Name</th>
<th>CVR</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Vyághra Çväsana</td>
<td>0.9</td>
<td>15</td>
<td>Pavanamuktásana</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Pärçva Úrdha Hastásanā</td>
<td>0.5</td>
<td>16</td>
<td>Bhujaigásana</td>
<td>0.9</td>
</tr>
<tr>
<td>3</td>
<td>TáåäsanaPratyägama</td>
<td>1</td>
<td>17</td>
<td>Tiryaka Bhujaigásana</td>
<td>0.6</td>
</tr>
<tr>
<td>4</td>
<td>bhunamanPratyägama</td>
<td>0.7</td>
<td>18</td>
<td>Dhanurásana</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>Naukásaïcälana</td>
<td>0.9</td>
<td>19</td>
<td>Setubandhásana</td>
<td>0.6</td>
</tr>
<tr>
<td>6</td>
<td>Súryanamaskāra</td>
<td>1</td>
<td>20</td>
<td>Matsyásana</td>
<td>0.5</td>
</tr>
<tr>
<td>7</td>
<td>Trikoëäsana</td>
<td>0.7</td>
<td>21</td>
<td>Naukásaï</td>
<td>0.7</td>
</tr>
<tr>
<td>8</td>
<td>Tiryaka Trikoëäsana</td>
<td>0.8</td>
<td>22</td>
<td>Uttánapádásana</td>
<td>0.6</td>
</tr>
<tr>
<td>9</td>
<td>Pärçvakotíásan</td>
<td>0.5</td>
<td>23</td>
<td>Çaväsana</td>
<td>1</td>
</tr>
<tr>
<td>10</td>
<td>Vakrásana</td>
<td>1</td>
<td>24</td>
<td>Anuloma- Viloma</td>
<td>1</td>
</tr>
<tr>
<td>11</td>
<td>Maëöükäsana</td>
<td>0.9</td>
<td>25</td>
<td>Bhrámaré</td>
<td>0.8</td>
</tr>
<tr>
<td>12</td>
<td>Garbhásana</td>
<td>0.7</td>
<td>26</td>
<td>Guided Meditation on the Visualization of Pancreas</td>
<td>0.7</td>
</tr>
<tr>
<td>13</td>
<td>Úñörásana</td>
<td>0.7</td>
<td>27</td>
<td>Agnisäarakryā</td>
<td>0.7</td>
</tr>
<tr>
<td>14</td>
<td>Bålásana</td>
<td>0.5</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**Table 2:** Practices with a CVR score of $\leq 0.49$.  

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Practice</th>
<th>CVR</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Sasāigāsana Çvāsana (Rabbit breathing)</td>
<td>0.3</td>
</tr>
<tr>
<td>2</td>
<td>Citrapataīga (Butterfly)</td>
<td>0.1</td>
</tr>
<tr>
<td>3</td>
<td>Dorsal stretch</td>
<td>0.2</td>
</tr>
<tr>
<td>4</td>
<td>Tāāsāna</td>
<td>0.1</td>
</tr>
<tr>
<td>5</td>
<td>Vērāsāna</td>
<td>0.4</td>
</tr>
<tr>
<td>6</td>
<td>Jānusirāsāna</td>
<td>0.3</td>
</tr>
<tr>
<td>7</td>
<td>Vyāghrāsāna</td>
<td>0.4</td>
</tr>
<tr>
<td>8</td>
<td>Ardhapādāpaścimottānāsāna</td>
<td>0.3</td>
</tr>
<tr>
<td>9</td>
<td>Kūmrāsāna</td>
<td>0.3</td>
</tr>
<tr>
<td>10</td>
<td>Bhardväjāsāna</td>
<td>0.3</td>
</tr>
<tr>
<td>11</td>
<td>Makarāsāna</td>
<td>0.4</td>
</tr>
<tr>
<td>12</td>
<td>Çalabhāsāna</td>
<td>0.3</td>
</tr>
<tr>
<td>13</td>
<td>Halāsāna</td>
<td>0.4</td>
</tr>
<tr>
<td>14</td>
<td>Kapālabhāti</td>
<td>0.4</td>
</tr>
</tbody>
</table>

**Table 3:** Yoga module for Adolescents with T1D

**Special Yoga Module for Type 1 Diabetes Mellitus**

<table>
<thead>
<tr>
<th>Sl. no</th>
<th>Practice (Saà skrata)</th>
<th>Practice (English)</th>
<th>Round</th>
<th>Time, minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Starting Prayer (shna vvt u......)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Specific Kriyā for Type 1 Diabetes mellitus</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a.</td>
<td>Agnisāra kriyā</td>
<td>3</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Specific loosening practice for Type 1 Diabetes mellitus</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a.</td>
<td>Pārṣva Udṛhva Hastāsāna</td>
<td>Side bending</td>
<td>5 each side</td>
<td>1</td>
</tr>
<tr>
<td>b.</td>
<td>Tāāsāna Pratyāgama</td>
<td>Mountain pose twist</td>
<td>5 each side</td>
<td>1</td>
</tr>
<tr>
<td>c.</td>
<td>Bhūnāman Pratyāgama</td>
<td>Greeting the earth pose with twist</td>
<td>5 each side</td>
<td>1</td>
</tr>
<tr>
<td>d.</td>
<td>Naukāsai cālana</td>
<td>Rowing the boat flow</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>Specific breathing practice for Type 1 Diabetes mellitus</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a.</td>
<td>Vyāghrā Çvāsana</td>
<td>Tiger breathing</td>
<td>5 up &amp; down</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>Śūryanamaskāra (Slow speed 3 to 6 round according to an individual’s capacity)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Specific relaxation after breathing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a.</td>
<td>Çvāsāna (with “A-kar” chanting)</td>
<td>Quick relaxation technique</td>
<td>1</td>
<td>1-2</td>
</tr>
<tr>
<td>7</td>
<td>Specific Standing Āsana for Type 1 Diabetes mellitus</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a.</td>
<td>Trikoēsāna</td>
<td>Triangle Pose</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>b.</td>
<td>Tīryaka Taōāsānāa</td>
<td>Mountain Pose</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>c.</td>
<td>Pārṣvakoēsāna</td>
<td>Side Angle Pose</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>30 second relaxation after each Āsana (as per the condition)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Specific Seating Āsana for Type 1 Diabetes mellitus</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a.</td>
<td>Vakrāsāna</td>
<td>Spine twist pose</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>b.</td>
<td>Maēōukāsāna</td>
<td>Frog pose</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>c.</td>
<td>Garbhāsāna</td>
<td>Embryo pose</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>
d. Üñör äsana  
Camel pose  
1 1  
e. Bäläsana  
Child pose  
1 1  
f. Pavanamuktäsana  
Wind relieving pose  
1 1  

10. 30 second relaxation after each Äsana (as per the condition)

11. Specific Supine Äsana for Type 1 Diabetes mellitus

a. Setubandhäsana  
Bridge pose  
1 1  
b. Matsyasana  
Fish pose  
1 1  
c. Naukäsana  
Boat pose  
1 1  
d. Uttánapadäsana  
Raised leg pose  
1 1  

12. 30 second relaxation after each Äsana (as per the condition)

13. Specific Prone Äsana for Type 1 Diabetes mellitus

a. Bhujãgäsana  
Cobra pose  
1 1  
b. Tiryaka Bhujãgäsana  
Swaying cobra pose  
1 1  

1. Specific relaxation after Äsana for Type 1 Diabetes

a. Çaväsana  
Dep relaxation technique  
1 5  

2. Specific Pranayama for Type 1 Diabetes mellitus

a. Anuloma- Vilo ma  
Alternate nostril breathing  
9 5  
b. Bhrãmaré  
Bee sound  
9 5  

3. Specific Meditation for Type 1 Diabetes mellitus

a. Guided Meditation on the Visualization of Pancreas  
1 10  

4. Closing prayer (svěN uz in)n

Time duration – 60 min

V. Discussion

In the present study, we developed a JYM for adolescents with T1D by choosing specific yoga practices from the traditional literature and scientific studies on yoga to target certain symptoms of adolescents with T1D. Validated JYM by the yoga experts taking their suggestions is finalized. Similarly, an effort was made to retain only those practices which were rated by all experts as useful. The yoga practices are included, as suggested by the experts. All the experts opined that these practices should be easy for children and adolescents with T1D. Relaxation practice is also included between the session as per the advice of the experts. So, the matching of yoga practices with symptoms of adolescents finalized after reviewing traditional literature (Saraswati, 2004; Mukibodha, 2000). The present study was closely associated with previous studies on the validation of JYM (Ahilan, 2015; Amrita et al., 2009; Author, 2019; Balaji et al., 2012; Baro, 2016; Berger et al., 1977; Chandrasekhar, 2009; Dubey et al., 2014; Eda, 2014; Kudigra & Ns, 2018; Kumar, 2017; Kumar, 2015; Metri et al., 2017; Prabhu et al., 2015; Raj, 2016; Raveendran et al., 2018; Rodrigues, 2016; Sharma et al., 2013, 2014; Shrivastava et al., 2017; Vaishali et al., 2012; Campagne, 1985).

In the present, there is no previous study that focused on the validation of a yoga module for T1D. This study is done in two phases:

a) We are designing the yoga module for T1D, b) expert validation of the module for T1D.

In the first phase, the JYM was designed based on literature reviews of traditional text reference and recent research publications. We did not find any direct source for yogic practice capable of improving T1D symptoms. However, the latest Hatha Yogic text has increasingly emphasized on improving health through different yogic practices. Besides, recent findings on T1D reported by several schools of yoga have helped in the formulation of a yoga module for T1D. The CVR calculation for all 41 practices is completed in our yoga module. Of these, 27 practices (CVR≥0.42) were included in the validated yoga module (Table 1). The remaining fourteen poses (Table 2) (CVR <0.49), namely Butterfly, Tadasana, (0.1), Dorsal stretch (0.2), Rabit breathing, Janusirasana, Ardhapadapachimittanasana, Kurmasana, Bharadwajasana, Salabhasana (0.3), Veerasana, Vyaghrasana, Makarasana, Halasana, Kapalbhati (0.4) were used as a complementary for important posture to stimulate the pancreases and synchronization along with body and mind. These practices were slightly challenging for T1D therapy. Apart from these fourteen practices, the 27 poses included for T1D treatment; thus, the final CVR satisfied the minimum value, as per Lowshe’s CVR.
Similar to any other exercise protocol, an ideal yoga module consists of frequencies, intensities, duration, and progression. Determining the appropriate mode depends upon the patient’s preference and safety issues associated with the T1D or other conditions. Keeping in view the safety and patient’s ability the duration and frequency of the pose customized for practice (Table 3).

Cīthlikaraē Vaśyāma (Loosening Practice) include in this module helped in loosening the joint and strengthen the muscles, which consequently helped in improving the function of abdominal organs (Dhirendra, 1973).

Sūryanamaskāra (Sun Salutation), A series of dynamic yoga posture in a specific sequence, stimulate insulin production through brain signaling, exerting beneficial effects on the glycemic outcome (Raj, 2016).

Yogāsana (Yoga Posture) rejuvenates of pancreatic cells through the alternating abdominal contraction and relaxations involved in yoga practice. Improves blood supply to muscles, enhances insulin receptors expression in the muscles, with forwards bending pose, manage and pressurizing the pancreas, stimulating insulin secretion (Ahilan, 2015; Eda, 2014).

Cūttihkriyā (Cleansing Processes), Agnisārā Kriyā (stimulating the digestive fire) involves pulling the abdomen in and snapping it backward and forward while holding one’s breath. Helps in the producing of insulin and controlling glucose levels in the blood; the effect of this action massage the internal organs and increases blood flow to the area (Kudigra, 2018; Raveendran et al., 2018).

Praśāyāma (regulated breath), Anulomvilom (alternate nostril breathing), improves components of health-related fitness, cardio respiratory endurance, flexibility, and body fat percentages.

Bhāmaré (humming bee breath), a soothing and calming effect on the mind, improves mental and physical health (Author, 2019; Sreedevi, 2017).

Dhyāna (Meditation): This leads to beneficial psychological effects, such as a faster reaction to stimuli and less prone to various forms of stress, anxiety reduction, and blood pressure control. Meditation on the Manipur Chakra (solar plexus), visualization of the pancreas during meditation, gives positive effects on sugar levels (Balaji et al., 2012; Eda, 2014; Raj, 2016).

VI. Conclusion

A comprehensive and traditional texts based yoga module was developed and validated by 20 experts who agree to most of the practices. Whoever, future studies must determine the feasibility and efficacy of T1D.

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None
Conflict of interest
None

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References Références Referencias


of anthropometric measures in type-2 diabetes. 11(1), 44–47. [https://doi.org/10.15406/ijcam.2018.11.00345]


71. Yoga for diabetes mellitus. (n.d.).