

Case Series



Efficacy of *Shigru Patra Kashaya* (*Moringa oleifera*) and structured yoga protocol in the management of obesity: A case series.

[¹Vidya P Gani, ^{2*}Keertan M S, ³Ashok Patil](#)

ABSTRACT:

Background: Obesity has transformed into a global epidemic, amidst insulin resistance and chronic inflammation as a predominant contributor. *Ayurveda* explains *Sthoulya* as excess *Meda Dhatu*, in analogous to obesity. Modern management like surgery and certain medications have notable side effects, highlighting the need for safer, effective alternatives. The study seeks to evaluate the efficacy of *Shigru Patra Kashaya* combined with a yoga protocol for *Sthoulya* management. **Clinical findings:** Patients coming to xxx opd of department of xxx, having the classical signs and symptoms of *Sthoulya* according to *Ayurveda* and BMI more than 25 kg/m² according WHO guidelines. 4 *Sthoulya* patients diagnosed and enrolled in the clinical case study finished their treatment. **Intervention:** *Shigru patra Kashaya* 50ml 2 times a day after 1 hr of food along with yoga protocol for 30 days. There was no intervention of any diet chart. Assessments are done through various clinical measures, like Karada scan and anthropometric measurements. **Outcome:** As a result of the treatment plan, the anthropometric measurements, Karada scan, and *Sthoulya* signs and symptoms were significantly decreased. **Conclusion:** This case series highlights that *Shigru Patra Kashaya* 50ml BD after 1 hr of food, when integrated with a structured yoga protocol for 30 days, without any dietary intervention can present a safe, widespread and effective approach for managing *Sthoulya*. The intervention demonstrated notable reductions in body weight, BMI, body fat indices and anthropometric measures addressing both metabolic imbalances and lifestyle factors which serve as a sustainable alternative with minimal risk of adverse effects.

KEYWORDS: *Sthoulya*, obesity, yoga, *Shigru Patra Kashaya*, *Moringa oleifera*, case series

RECEIVED ON:

05-08-2025

REVISED ON:

21-08-2025

ACCEPTED ON:

01-09-2025

Access This Article Online:

Quick Response Code:



Website Link:

<https://jahm.co.in>

DOI Link:

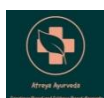
<https://doi.org/10.70066/jahm.v13i8.2266>

Corresponding Author Email:

keertanms@gmail.com

CITE THIS ARTICLE AS

Vidya P Gani, Keertan M S, Ashok Patil. Efficacy of *Shigru Patra Kashaya* (*Moringa oleifera*) and structured yoga protocol in the management of obesity: A case series. *J of Ayurveda and Hol Med (JAHM)*.2025;13(8):122-129



1. INTRODUCTION

World health organization defined both obesity and overweight as “abnormal or excessive fat accumulation that poses a health concern”. The epidemic of obesity is thought to have many causes, like the globalization of food systems, but it is also likely related to the decline in physical activity brought on by contemporary lifestyle. Countries like the United States, India, China, Germany, Pakistan, Indonesia, Russia, Mexico, Brazil and Egypt are home to more than half of the world’s obese population. Nearly the world’s one third population is obese or overweight. [1]

Obesity is assessed using body mass index also known as BMI. BMI more than 25 indicates overweight, more than 30 indicates obesity. BMI of 30 -35 is considered as class I obesity, 35-40 class ii obesity and more than 40 class iii obesity. For assessing overweight and obesity BMI has become a useful tool universally across different age groups and genders.

In NFHS-5, the percentage of overweight or obese girls has increased from 20.6 to 24 percent from NFHS-4. Urban areas have a higher percentage of 33.2 compared to rural areas with 19.7%.the prevalence of illness in men has also increased from 18.9 % (NFHS-4) to 22.9% (NFHS-5). The NFHS-4 report indicates that "Obesity prevalence is lower in lower socioeconomic levels (Bihar, Jharkhand, Chhattisgarh, and Madhya Pradesh) than in higher socioeconomic ones (Punjab, Chandigarh), Goa, Delhi, Andhra Pradesh, Telangana, Puducherry, and the North-Eastern states)". [2]

Sthoulya which is mentioned in classics can be linked to obesity, characterized by significant modifications in

lipid metabolism. Individual characterized by excessive accumulation of fat and flesh refers to as *Sthula*, resulting in a visibly disproportionate enlargement of the *Chala sphika udara stana* (buttocks, belly, breasts), *Aayushohrasa* (*life span reduced*), *Krichha vyavaya* (difficult intercourse), *Kshudatimatra* (excessive hunger)and *Pipasatiyoga*(*excessive thirst*), *Shaithilya*(*flabbiness*) and *Gatrasada* (fatigue)etc without increase in energy. Overeating and lack of physical activity often results into obesity, and eating patterns during adolescence have a significant role in later life obesity risk. [3]

Avarana of the *Srotas* by the *Meda*, there is *Kosthasthit Samana Vayu Vridhhi* which leads to *Sandhukshan*(*kindling*) of *Jatharagni*, which in turn leads to rapid digestion of consumed food and leaves the person crave for more food. [4]

Obesity is made worse by diabetes, inflammation, hyperlipidaemia, hypertension, insulin resistance, thrombosis, metabolic syndrome and other secondary diseases. Modern science treats obesity with artificial drugs, bariatric operations etc, which are having a number of negative effects. [5]

Multiple treatment modalities have been devoted to the management of *Sthoulya* in *Ayurveda*, like medication, procedures and *Pathya Apathya. Guru And Apatrapana* (depleting) treatment are the choice of management for *Sthoulya*.

Drugs possessing the *Katu, Tikta, Kashaya Rasa, Laghu Ruksha Guna and Ushna Virya* have *Medohara* and *Lekhaneeya*(*scraping*) activities are recommended. [6]

Ayurvedic remedies that are said to be helpful in *Sthoulya*, needs scientific proof. To address these problems and give better results, *Ayurvedic Kashaya* along with yoga protocol for *Sthoulya* has been planned.

2. CASE REPORT

Criteria for diagnosis and assessment

The diagnosis was mainly based upon anthropometric measurements along with Karada scan (fat analysis) and

a. Clinical findings (Table no. 1)

Parameter	Case 1 (27/F)	Case 2 (31/F)	Case 3 (35/F)	Case 4 (55/M)
BMI	26.5	28.1	41.2	31.9
Symptoms	Weight gain, fatigue, increased appetite, perspiration	Hypothyroidism, weight gain, fatigue, breathlessness	Weight gain, fatigue, snoring, binge eating	Breathlessness, fatigue, knee pain, disturbed sleep
Dietary Pattern	Vegetarian, <i>Madhura-Katu</i> , <i>Snigdha</i> , frequent coffee intake	Mixed diet, <i>Amla-Katu</i> , oily/junk food, sweet craving	Mixed diet, oily non-veg 4x/week, sweet cravings, binge eating	Non-veg preference, dairy-heavy, <i>Madhura-Amla-Katu</i>
Sleep Pattern	Sound sleep, <i>Divaswapna</i> (sleeping in day time)	Sound sleep, <i>Ratrijagarana</i> (staying awake at night)	Sound sleep, <i>Divaswapna</i>	Disturbed sleep, <i>Diwaswapna</i> + <i>Ratrijagarana</i>
Medical history	None	Hypothyroidism	None	None

b. Intervention

These 4 patients are treated with the treatment which has its reference in *Kaiyadeva Nighantu* –

c: Timeline (Table no. 2)

Duration of treatment	Drug used	Dosage	Karma	Results	Follow up
30 days	<i>Shigru Patra Kashaya</i>	50ml BD 1hr after food	<i>Deepana</i> , <i>Rochana</i> , <i>Ruksha</i> , <i>Kaphavataghna</i> , <i>Medoghna</i>	prevention of preadipocytes from adipocyte differentiation.	31 st day and after 1 month of stopping medicine

other signs and symptoms mentioned in *Ayurvedic* texts and the BMI (body mass index). On day zero and after the treatment, follow up after 1 month of stopping medicine assessed obesity patients. The treatment was concluded upon the 30th day. Karada scan as well as anthropometric measurements like various clinical measure were done by way of assessments.

Oushadhivarga (740-748). [7] Participants were advised to maintain their usual diet; no standardized diet chart was implemented.

Table 3: Yoga protocol

Asanas	Duration
Tiryaktadasana (swaying palm tree pose)	3 min
Trikonasana (triangle pose)	3 min
Konasana (angle pose)	3 min
Padahasthasana (hand to foot pose)	1 min
Ardhahalasana (half plow pose)	3 min
Dwicakriasana (cycling pose) repetitive	3 min
Bhujangaasana (cobra pose)	3 min
Salabhasana (locust pose)	1 min
Chakkiasana (mill churning pose)	3 min

Sthitta konaasana (static angle pose)	3 min
Paschimottanasana (seated forward bend pose)	1 min
Ujjayi (victorious breathing)	3 min
Anulom-vilom (alternative nostril breathing)	6 min
Brahmari (humming breath)	3 min
Nadanusandan (A-U-M chanting)	5 min

d. Follow up and outcome (Results): Before treatment, after treatment and follow up after 1 month of stopping medicine results are enumerated in table 4 & 5.

Table 4: Assessment of the patients (before treatment, after treatment and after 1 month of stopping medicine)

Assessment parameters	Case 1			Case 2			Case 3			Case 4		
	BT(24/05/25)	AT (24/06/25)	AF (25/07/25)	BT (15/05/25)	AT (15/06/25)	AF (16/07/25)	BT (27/04/25)	AT (28/05/25)	AF (27/06/25)	BT (1/06/25)	AT (2/07/25)	AF (1/07/25)
Weight	65.3 kg	62.5 kg	61 kg	72 kg	68.5 kg	67.2 kg	89 kg	84.8 kg	83.6 kg	91.1 kg	87 kg	85.1kg
Height	157 cm	157 cm	157cm	160 cm	160 cm	160 cm	147 cm	147 cm	147 cm	169 cm	169 cm	169cm
BMI	26.5 kg/m ²	25.4 kg/m ²	24.7 kg/m ²	28.1 kg/m ²	26.8 kg/m ²	26.3 kg/m ²	41.2 kg/m ²	39.3 kg/m ²	38.7 kg/m ²	31.9 kg/m ²	30.4 kg/m ²	29.8 kg/m ²
Total fat	38.2 %	36.0 %	34.9%	35 %	31.6 %	30.2%	43.4 %	40.2 %	39.4%	32.8 %	30.1 %	28.2%
Visceral fat	7.0 %	6.0 %	5%	5.5 %	4.7 %	4.1%	27.5 %	24.0 %	22.8%	20.5 %	18 %	16.5%
Metabolic rate	1315 Kcal	1340 Kcal	1368 Kcal	1276 Kcal	1300 Kcal	1378 Kcal	1638 Kcal	1652 Kcal	1681 Kcal	1874 Kcal	1890 Kcal	1908 Kcal
Body age	43	40	39	43	40	39	64	61	60	64	61	60
Subcutaneous whole-body fat	32.6 %	30.1%	28.9%	29.3%	27.1%	26.3%	42.4%	39.0%	37.1%	23.3%	20.9%	19.5%
Trunk	29.4%	27.0%	25.6 %	26.1%	23.2%	22.9%	40.0%	36.5%	35.3%	21.7%	19.8%	18.1%
Arms	53.5%	50.0%	49.3%	48.6%	43.1%	42.5%	58.2%	53.0%	52.0%	31%	27%	25.9%
Legs	49.6%	46.0%	45.7%	43.5%	39.5%	38.6%	50.2%	46.5%	45.1%	31.6%	29.22%	28.1%
Skeletal whole-body fat	22.6%	23.5%	24.1%	23.8%	24.5%	24.9	20.3%	21.2%	22.3	27.4%	29.5%	31.5
Trunk	17.4%	18.3%	19.2%	18.6%	19.2%	20.0%	13.3%	14.0%	15.9%	19%	22%	23.9%

Arms	22.6%	23.2%	24.1%	24.8%	25.2%	25.7%	14.7%	15.2%	16.3%	33.4%	35%	36.2%
Legs	34.9%	35.5%	36.0%	35.4%	36.1%	36.8%	35.0%	36.0%	37.6%	44.9%	45.8%	46.8%
Mid arm circumference	Rt - 30cm	Rt - 29cm	Rt- 28.5cm	Rt - 30cm	Rt - 29cm	Rt -28.5 cm	Rt - 39.5cm	Rt - 38cm	Rt - 37cm	Rt - 32.5cm	Rt - 31cm	Rt- 29cm
	Lt - 30cm	Lt - 29cm	Lt- 28.5cm	Lt -30cm	Lt -29cm	Lt -28 cm	Lt -40cm	Lt - 38.5cm	Lt- 37.5cm	Lt - 32cm	Lt - 31.5cm	Lt- 28.5cm
Mid-thigh circumference	Rt - 52cm	Rt - 50cm	Rt- 49cm	Rt - 49cm	Rt - 47cm	Rt -46.5 cm	Rt - 68cm	Rt - 66cm	Rt - 65.5cm	Rt - 55cm	Rt - 53.5cm	Rt- 25cm
	Lt - 53cm	Lt - 51cm	Lt -50cm	Lt -49cm	Lt -47cm	Lt -46 cm	Lt -68cm	Lt -66cm	Lt- 65cm	Lt - 55cm	Lt - 53.5cm	Lt- 52.5cm
Abdominal circumference	88 cm	84 cm	83 cm	81 cm	77 cm	76 cm	95 cm	91 cm	89.5cm	115 cm	112 cm	111.5 cm
Waist circumference	82 cm	79 cm	77 cm	78 cm	76 cm	75.5 cm	93 cm	88 cm	87cm	118 cm	114 cm	113.5 cm
Hip circumference	85 cm	83 cm	82.5 cm	94 cm	90 cm	89 cm	116 cm	114.5 cm	112.5cm	115 cm	112 cm	110.5 cm

Table 5: Effectiveness of Treatment on Various Parameters

Parameter	Mean 0 th day	Mean 31 st day	Mean AF	Mean difference	T value	P value
Weight (kg)	79.35	75.7	74.225	5.125	13.916	0.000803
BMI (kg/m ²)	31.93	30.48	29.875	2.050	12.361	0.001140
Total Fat (%)	37.35	34.48	33.175	4.175	12.367	0.001139
Visceral Fat (%)	15.13	13.18	12.100	3.025	3.839	0.031153
Abdominal circumference (cm)	94.75	91.00	90.000	4.750	10.969	0.001622
Waist circumference (cm)	92.75	89.25	88.250	4.500	6.1142	0.008793
Hip circumference (cm)	102.5	99.625	98.625	3.875	6.9903	0.006010
Mid arm circumference (cm)	32.0	30.875	31.9375	1.750	5.4221	0.012308
Mid-thigh circumference (cm)	56.0	54.375	53.375	2.750	26.944	0.000112

3. DISCUSSION

In *Ayurveda* *Sthoulya* is classified under *Santarpanothta Vikara* – over nutrition and indulgent lifestyle disorder. [8] The *Samprapti* (pathogenesis) of *Sthoulya*

comprehend aggravation of *Kapha Dosha*, influenced by *Aharaja* (dietary), *Viharaja* (lifestyle) and *Manasika* (psychological) factors,[9] leading to *Medo Dhatu Vridhhi* (increase adipose tissue), *Dhatwagni Mandya*

(impaired metabolism) and *Srotorodha* (obstruct body channels). This proliferation of *Meda* obstructs bodily channels and disturbs metabolic equilibrium, manifesting clinically as obesity.

The present case series ascertained the effectiveness of *Shigru Patra Kashaya* (*Moringa oleifera*) combined with a structured yoga protocol over 30 days. All 4 patients presented with the typical signs and symptoms of *Sthoulya*, including increased body weight, fat percentage, and associated symptoms like fatigue, breathlessness, and disturbed bowel habits. After treatment assessments revealed that consistent reductions in anthropometric parameters, body fat indices and visceral fat content.

The justification behind using *Shigru Patra Kashaya* is well established in *Ayurvedic* pharmacology. *Shigru* flaunts *Katu* and *Tikta Rasa*, *Laghu*, *Ruksha*, and *Teekshna Guna*, *Ushna virya*, and *Katu Vipaka*, making it *Kapha-Vata hara*, *Medohara* (fat reduction), and *Lekhana* (scraping). These attributes amplify *Agni* (digestive and tissue metabolism), reduce *Kapha*, and help scrape excess *Meda* from the system. [10] Modern pharmacological studies stand by these effects, accredit moringa's anti-obesity action to its high antioxidant, flavonoid, and fibre content, which regulate lipid metabolism, suppress adipocyte differentiation, and improve insulin sensitivity. [11]

The plants lipolytic and antioxidant properties are contributed by the Nutritional components such as vitamin C, tocopherols, polyphenols, and essential minerals. [12] Moreover, ascorbic acid has been

recounted to play a significant role in fat oxidation and metabolic modulation. [13]

The yoga protocol introduced in this study has included asanas and pranayama aiming at core stability, elasticity, and de-stressing which has worked more than pharmacological intervention. Both the physical and psychological areas of obesity are managed by yoga. The fusion of moving sequence, respiratory methods, breath control and conscientiousness are known to lower cortisol levels, which are involved in stress-induced eating behaviours and fat accumulation—particularly in the abdominal region. [14]

There is notable improvement by each patient in various domains. Average weight decreased from 79.35 kg to 75.7 kg, and BMI dropped from 31.93 to 30.48. Significant reduction was seen in visceral fat, total fat as well as mid-arm, thigh, waist, and hip circumferences. Statistical analysis showed that most parameters reached significance ($p < 0.05$), and there were changes after stopping the medicine indicating a genuine therapeutic effect.

The merging of *Shigru Patra Kashaya* and yoga showed a mutualistic effect, addressing both metabolic dysfunction and lifestyle-related causes to obesity. Unlike modern treatments that often involve pharmacological agents or trespassing procedures with adverse effects, this approach offers a safe, holistic, and ethical alternative

Weight regulation, both in animal models and human trials, where it influenced appetite, reduced caloric intake, and improved lipid profiles, previous studies also support moringa's efficacy. Positive outcomes in

emotional regulation, quality of life, and metabolic health, especially in overweight and obese individuals, yoga interventions have demonstrated. [15]

4. CONCLUSION

Sthoulya, or obesity, is a metabolic illness that causes diseases linked to too much fat which leads to CVD etc. 4 *Sthoulya* cases were treated with a 30 days *Shamana Oushadhi* of *Shigru Patra Kashaya* (50ml BD after 1 hr of food) and a structured yoga protocol, no specific dietary chart was provided to the participants. No adverse effects were reported and marked reduction in weight, BMI, visceral and total fat, abdominal and waist circumference were observed, along with improved fatigue, breathlessness and sleep. Metabolic rate also improved in all cases.

Shigru Patra Kashaya, along with its *Lekhana* and *Medohara* qualities with yoga offers a safe and holistic approach towards *Sthoulya*, effectively addressing metabolic imbalance and lifestyle causes while enhancing overall well-being.

Declaration of Patient Consent – The authors confirm that they have acquired a patient consent form, in which the patient or caregiver has granted permission for the publication of the case, including accompanying images and other clinical details, in the journal. The patient or caregiver acknowledges that their name and initials will not be disclosed, and sincere attempts will be undertaken to safeguard their identity. However, complete anonymity cannot be assured.

Patient perspective - patients experienced satisfactory changes, which also improved their quality of life.

Authors Details:

¹PG Scholar, Dept of Swasthavritta & Yoga, KLE Academy of Higher Education and Research, Deemed to be University, Shri BMK Ayurveda Mahavidyalaya, Shahpur, Belagavi, Karnataka, India.

^{2*} Professor, Dept of Roga Nidana, KLE Academy of Higher Education and Research, Deemed to be University, Shri BMK Ayurveda Mahavidyalaya, Shahpur, Belagavi, Karnataka, India.

³Professor, Dept of Swasthavritta & Yoga, KLE Academy of Higher Education and Research, Deemed to be University, Shri BMK Ayurveda Mahavidyalaya, Shahpur, Belagavi, Karnataka, India.

Authors Contribution:

Conceptualization and clinical management: Dr. VPG, Dr. KMS, Dr. ASP

Data collection and literature search: Dr. VPG

Writing – original draft: Dr. VPG

Reviewing & editing: Dr. VPG, Dr. KMS, Dr. ASP

Approval of final manuscript: All authors

Conflict of Interest – The authors declare no conflicts of interest.

Source of Support – The authors declare no source of support.

Additional Information:

Authors can order reprints (print copies) of their articles by visiting:

<https://www.akinik.com/products/2281/journal-of-ayurveda-and-holistic-medicine-jahm>

Publisher's Note:

Atreya Ayurveda Publications remains neutral with regard to jurisdictional claims in published maps, institutional affiliations, and territorial designations. The publisher does not take any position concerning legal status of countries, territories, or borders shown on maps or mentioned in institutional affiliations.

REFERENCES:

1. World Health Organization. Obesity and Overweight [Internet]. World Health Organisation.2025. Available from: <https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight>
2. Release of NFHS-5 (2019-21) – Compendium of Factsheets Ministry of Health and Family Welfare |GOI [Internet]. main.mohfw.gov.in. Available from: <https://main.mohfw.gov.in/basicpage-14>
3. Tejaswini N K, Reena K, Raghavendra Rao. Impact of eating habits on adolescent obesity- A case control study. JAHM [Internet].2025Jun.19 [cited 2025Aug.12];13(5):52-61. Available from: <https://jahm.co.in/index.php/jahm/article/view/1971>

4. Kale V S (editor). Manorama Hindi commentary on Charaksamhita of Agnivesha, Sutrasthana, Chapter 21, verse no. 5, 2nd edition, Delhi, Chaukhamba Orientalia ;2016; 308.
5. Kelly T, Yang W, Chen C-S, Reynolds K, Global burden of obesity in 2005 and projections to 2030. *International Journal of Obesity* [Internet]. 2008 Jul 8;32(9):1431-7. Available from: <https://www.nature.com/articles/ijo2008102>
6. Kumari H, K Nishteshwar, Reshmi Pushpan. Medohara and Lekhaniya dravyas (anti-obesity and hypolipidemic drugs) in Ayurvedic classics: A critical review. *Ayu*. 2013 Jan 1;34(1):11-17. DOI: 10.4103/0974-8520.115437
7. Priyavata Sharma (editor). Kaiyadeva Nighantu, Oushandivarga, chapter 2, verse no. 745, 1st edition, Varanasi; Chaukhamba Orientalia;2006;170
8. Pardhekar AD, Wajpeyi SM, Gotarkar S. Comprative clinical efficacy of Tryushanadi Guggul and Navaka Guggul in Sthoulya (Overweight). *International Journal of Ayurvedic Medicine*. 2023 Apr 4;14(1):121-30. Available from: <https://www.ijam.co.in/index.php/ijam/article/view/3203>
9. Tyagi T, Sharma S, Sharma R. Management of Life style disorder: Sthaulya (Obesity) through Pathya-apathya (Diet and behavioural restrictions) and Ekal Dravya (Single Herb). *JAHM* [Internet]. 2023Jul. 17 [cited 2025Aug. 1];11(6). Available from: <https://jahm.co.in/index.php/jahm/article/view/919>
10. Sastry J L N (editor). *Dravyaguna Vijnana*, chapter 1, 2nd edition Varanasi; Chaukhamba Orientalia;2005;139-143.
11. Ali Redha A, Perna S, Riva A, Petrangolini G, Peroni G, Nichetti M, et al. Novel insights on anti-obesity potential of the miracle tree, *Moringa oleifera*: A systematic review. *Journal of Functional Foods*. 2021 Sep; 84:104600. Available from: <https://doi.org/10.1016/j.jff.2021.104600>
12. Sharma P C, Yelne M B, Dennis T J, Database on Medicinal Plants Used in Ayurveda, Vol. I, CCRAS, Dept of ISM & H, Ministry of Health & Family Welfare (Govt. of India); 2000;431.
13. Othman AI, Amer MA, Basos AS, El-Missiry MA. *Moringa oleifera* leaf extract ameliorated high-fat-diet-induced obesity, oxidative stress and disrupted metabolic hormones. *Clinical Phyto science*. 2019 Dec;5(1). Available from: <https://doi.org/10.1186/s40816-019-0140-0>
14. Cramer H, Lauche R, Langhorst J, Dobos G. YOGA FOR DEPRESSION: A SYSTEMATIC REVIEW AND META-ANALYSIS. *Depression and Anxiety*. 2013 Aug 6;30(11):1068-83. DOI:10.1002/da.22166
15. Ahmad J, Khan I, Johnson SK, Alam I, Din ZU. Effect of Incorporating Stevia and *Moringa* in Cookies on Postprandial Glycemia, Appetite, Palatability, and Gastrointestinal Well-Being. *J Am Coll Nutr*.2018 Feb;37(2):133-139. Available from: <https://doi.org/10.1080/07315724.2017.1372821>