



Development, Validation, and Verification of a Self-Assessment Tool to Estimate Agnibala (Digestive Strength)

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Abstract

According to Ayurveda, the traditional system of healthcare of Indian origin, *Agni* is the factor responsible for digestion and metabolism. Four functional states (*Agnibala*) of *Agni* have been recognized: regular, irregular, intense, and weak. The objective of the present study was to develop and validate a self-assessment tool to estimate *Agnibala*. The developed tool was evaluated for its reliability and validity by administering it to 300 healthy volunteers of either gender belonging to 18 to 40-year age group. Besides confirming the statistical validity and reliability, the practical utility of the newly developed tool was also evaluated by recording serum lipid parameters of all the volunteers. The results show that the lipid parameters vary significantly according to the status of *Agni*. The tool, therefore, may be used to screen normal population to look for possible susceptibility to certain health conditions.

Keywords

digestive fire, questionnaire, digestive power, digestive status, *Jatharagni*

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What Is Agni, and What Is Agnibala?

Ayurveda, the traditional system of health care that is native to India, considers *Agni* (the “fire” or “heat” principle) to be one of the most essential factors contributing to the health of an individual. The main function of *Agni* is to digest and metabolize the various components of the food and to help in subsequent tissue nourishment. Ayurveda classifies *Agni* into 3 major sets based on their locations and substrates on which they act. The first one, *Jatharagni*, acts on the food in the digestive tract and converts it into absorbable form.^{1,2} The second set of *Agni* is known as *Bhutagni*, and it is of 5 types. Each of these 5 acts on the 5 primordial constituents of the absorbed food: Earth, Water, Fire, Air, and Space. These 5 *Bhutagnis* transform the substrates into such form that can be assimilated at tissue level.³ The third set of *Agni* is called *Dhatvagni*, which is of 7 types based on the kind of tissue that it helps nourishing. *Dhatvagnis* act at tissue level and help in the process of tissue building.⁴ It may be noted that these 3 levels of action of *Agni* are very much similar to the 3 steps of metabolism that are understood in contemporary biochemistry: digestion (hydrolysis), intermediary metabolism (preparatory phase), and the Krebs cycle which takes place at a cellular level.⁵

physical and chemical transformations before it is rendered into acceptable form to be incorporated by various tissues. This transformation process, according to the principles of Ayurveda, completely depends on the strength of *Agni*. Stronger the *Agni*, quicker is the transformation, in general. On the contrary, if this *Agni* is weak, the transformation also is slow and incomplete. Ayurveda proposes four kinds of functional states of *Agni*: *Sama* (Regular), *Vishama* (Irregular), *Tikshna* (Intense), and *Manda* (Weak).⁶ *Tikshnagni* is supposed to be intense and hence, easily digests even a very heavy meal, in a very short span of time. *Mandagni* is opposite to the *Tikshnagni*: it is subdued in its activity. This *Agni* is unable to digest and metabolize even a small quantity of food. *Vishamagni* represents an unpredictable state of *Agni*: It sometimes quickly digests the food and at other times it does so very slowly. *Samagni* ensures complete digestion of the food ingested at the proper time without any irregularity. Its activity is neither too intense nor too weak. It is just appropriate and therefore, is ideal too. *Samagni* gets affected by improper diet and inappropriate eating habits.⁷ Ayurveda proposes different behavioral

Classification of Agni According to Its Strength

Whatever food material one ingests, cannot be assimilated in the same form. The ingested food undergoes a series of

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adjustments, changes in eating habits and even prescribes some herbs to regulate *Agni*, whenever its activity is not normal.

Clinical Importance of the Assessment of Agnibala

Ayurveda being one of the health care systems that rests on the concept of individualization and person-centric approach, the clinical assessment of *Agni* becomes vital in the context of dietary recommendations, lifestyle-related advices, and the choice of therapeutic interventions.^{8,9} Furthermore, since the status of *Agni* is likely to vary according to individual constitution, age, seasonal rhythm, and so on, it becomes even more important to accurately evaluate the strength of *Agni* in an individual from an Ayurveda point of view. From a purely therapeutic viewpoint too, *Agni* has been considered to be important since the nature of drugs, dosage, and routes of administration—all depend on the strength of *Agni*.¹⁰

Tools Available for the Assessment of Agnibala and Their Limitations

Some researchers have developed a few tools to estimate *Agnibala*; however, each has its own limitations. The following paragraphs describe the major contributions in this area so far.

Patil et al¹¹ have used a specific scoring pattern for the estimation of *Agnibala*. In this tool, a total of 20 scores are divided into the following categories: *Abhyavaharanashakti* (capacity to eat) (6 points), *Ruchi hi Aaharakale* (timely desire for consumption of food) (4 points), *Jaranashakti* (capacity to digest) (6 points), *Vata Mutra Purisha Retasam Mukti* (normal bowel and bladder movements) (4 points). However, to assess *Agnibala* in this method, one is required to be administered with known amount of *ghee* and needs to be observed for specific symptoms of digestion over a period of a day. Though it is advisable to go for this approach in a patient who is under clinical observation, it is difficult to follow this method in those cases of patients who give short visits to their physicians. Furthermore, this method uses the intervention of “administration of *ghee*.” Therefore, the process to be followed while preparing the *ghee*, details such as whether it should be prepared out of cow’s milk or buffalo’s milk, and other indicators such as how old should it be, what should be the dose according to the age, and so on are required to be further standardized. Furthermore, no data on validation and reliability are available for this tool.

Another tool for the assessment of *Agnibala* was developed in a work by Eswaran et al.¹² This tool is based on different features of *Vishmagni*, *Tikshnagni*, *Mandagni*, and *Samagni* collected from different classical Ayurveda textbooks. The questionnaire employs a close-ended Likert-type scale with 5 options for each question. There are a total of 64 questions in the tool. There are 14 questions under *Vishmagni*, 13 under *Tikshnagni*, 13 under *Mandagni*, and 24 questions under

Samagni. Though the tool has been validated in 250 healthy individuals, the list of items given in the tool does not specify as to “which state of *Agni* is being evaluated by what question.” It even does not mention the method of classifying the individuals based on the status of *Agni*. Thus, the tool is very cumbersome to use and is very lengthy. Furthermore, it does not exclusively rely on the features/symptoms specifically ascribed to the different states of *Agni* found in the Ayurveda literature. The tool contains many points that are not directly related to *Agnibala*.

Another tool for assessment of *Agnibala* has been developed by Pandey and Tripathi.¹³ This tool is based on the assumption that the assessment of *Agni* depends on the 3 components: *Abhyavaharana Shakti* (capacity to eat), *Jarana Shakti* (capacity to digest), and *Ruchi* (desire for food).¹⁴ Every question in this tool has 3 options: a, b, and c describing *Uttama Agnibala* (good strength), *Hina Agnibala* (inadequate strength), and *Vishama Agnibala* (unpredictable strength) respectively. Each option has been assigned with one score. The total number of questions is 23. *Agnibala* of an individual is determined on the basis of the maximum scores obtained for a particular category. This tool ignores the four states of *Agni*, making it difficult to be used to diagnose the accurate status of *Agni*. Furthermore, no data on validation and reliability are available for this tool.

Objectives of the Present Study

We decided to develop a tool to assess *Agnibala* that considers the specific features assigned to the four functional states of *Jatharagni* as the basis. The primary objective of the study was to develop and validate the *Agnibala* assessment tool. Along with the suitable statistical tests used for validation, we also intended to verify the tool based on certain biochemical parameters to ensure that the tool is practically useful. For this purpose, we recorded the serum lipid profile of 300 healthy volunteers, because this has been reported to show interindividual variations. Therefore, we hypothesized that, the lipid parameters would vary according to *Agnibala*. If such a relationship is proven, the tool may be used for various screening purposes. The ethical clearance was obtained by Institutional Ethical Committee before starting the study (No. EC/652).

Materials and Methods

Study Design

This study employs a cross-sectional observational design.

Population and Sample

The population for conduction of the present study was defined as the university students of either gender aged between 18 and 40 years registered during the academic years 2014 and 2015 from various programs of our university. Announcements were made in the classrooms regarding the study in various faculties of

Table 1. The Agnibala Assessment Tool.^a

Questions	I (Mandagni)	II (Vishamagni)	III (Samagni)	IV (Tikshnagni)
What option describes best your ability to digest food?	I am unable to digest even small quantities of food	My ability to digest food keeps varying. Sometimes I am able to digest and other times I am not	I am able to digest almost all sorts of food items when consumed in appropriate quantity	I am able to digest almost all food items very easily, even in large quantities
What time do you need to feel like eating again, after having your meal?	I feel like eating only after about 8 hours of having my meal	Not consistent, keeps varying	I feel like eating 6-8 hours after having my meal	I feel like eating before 6 hours of having meal
What effects do you observe in your digestion due to disturbances in your lifestyle? (eg, irregular eating habits, disturbed sleeping pattern, emotional disturbances, etc)	Digestion gets disturbed due to slight variation in lifestyle	Digestion gets disturbed due to appreciable disturbances in lifestyle	Digestion is not affected much due to disturbances in lifestyle	Process of digestion gets initially disturbed; however, later gets adapted to variations in lifestyle
How frequently do you have your meals in a day?	I have <2 meals per day	My frequency of having meals varies between 1 and 4	I usually have 2 to 3 meals per day	I almost always have >3 meals per day
How do you describe your ability to bear hunger? (ie, your ability to wait for food after you feel hungry)	I can bear hunger for >2 hours	Hunger is sometimes bearable (up to 1 hour) and sometimes is unbearable (<1 hour)	I can bear hunger for up to 1 to 2 hours	I feel it very difficult to bear hunger
What quantity of meals do you have in a day?	I usually have small meals	I sometimes have large and sometimes small meals	I usually have meals that are neither too small nor too large	I usually have large meals
How do you describe your capacity to digest heavy meals in terms of time?	Digestion mostly takes longer than normal	Time taken for proper digestion varies every now and then	Digestion is completed in normal time	Digestion occurs quite quickly than normal
How do you describe your bowel habits?	I have a tendency for constipation	My bowels are sometimes hard and on other times are soft	My bowels are normal (neither too hard nor too soft)	—
How do you describe your eating habits?	I generally have food after the scheduled time	I generally have food either before or after the scheduled time	I generally have food exactly on scheduled time	I generally have food before scheduled time
How do you feel after the complete digestion of meals?	I frequently feel heaviness in abdomen and body	I occasionally feel slight heaviness in abdomen and body	I mostly feel lightness in abdomen and body	I feel lightness in abdomen and body quite early after having meals
How do you express your feelings that you develop after looking at the food items that you like?	I do not feel like eating even when hungry	I sometimes feel like eating and sometimes do not	I feel like eating food	I feel like eating any food item irrespective of whether I like it or not
Total Scores:/11/11/11/10

^a Percentage Agnibala = $\frac{\text{Scores obtained for individual class of Agnibala}}{\text{Total scores allotted to that class of Agnibala}} \times 100$.

institution for recruitment of volunteers. Every volunteer who gave written consent was thoroughly examined clinically to ensure the participation of only clinically healthy volunteers. We had 300 volunteers in this study.

Preparation of the Preliminary Tool

Considering the deficits and limitations observed in the current methods of Agnibala estimation, we designed a “Self-assessment questionnaire” (Table 1) for recording the strength of Agni. This questionnaire is chiefly designed on the basis of classification of Agnibala (strength) as described in *Charaka Samhita* in

Vimanasthana (chapter 6, verse 12).⁶ This verse clearly depicts the 4 functional states of *Jatharagni*, namely, *Vishamagni*, *Tikshnagni*, *Mandagni*, and *Samagni*. The other features of Agni based on this mode of classification were also collected from other classical texts of Ayurveda, and a preliminary questionnaire was developed in such a way that simple questions or statements were designed to assess each feature of Agnibala. The tool required that the respondents record their agreement or disagreement with the question in appropriate columns by marking a check mark (✓) against the specific statement/question. The guidelines regarding the method of responding were clearly stated. Respondents were supposed to tick the statement/questions that best described their

physiology. One score was assigned for the specific response, if found to be present in that individual. Total scores were calculated in respective columns and subsequently the scores were converted into percentage for further statistical analysis. The status of *Agni* in an individual was decided on the basis of maximum percentage scores obtained under the different categories of *Agni*.

Content Validity

Content validity refers to how well the individual items in the assessment tool correspond to the concept of what is being measured.^{15,16} We followed a widely used method of measuring content validity, that is, by gauging the agreement among subject experts regarding how essential a particular item was. The tool was thus examined by Ayurveda experts during the seminar conducted in department that included experts from clinical disciplines. Each of the subject experts on the judging panel responded to the following question for each item: "Is the response elicited by this item 'essential,' 'useful, but not essential,' or 'not necessary' in the measurement of the *Agnibala*?" If more than half the experts indicated that an item was essential, that item was retained since it was presumed to have content validity. Thus, the preliminary tool contained 12 items.

Construct Validity

Construct validity is the appropriateness of inferences made on the basis of measurements, that is, whether a test measures the intended construct or not. The construct validity in designing the *Agnibala* assessment tool was done in the following manner: 100 volunteers were initially subjected to the trial in which the full preliminary questionnaire containing 12 items was administered. After analyzing the results, we found that 1 item was not attempted by most of the volunteers as these features were not normally found in healthy individuals. Thus we concluded to drop this item and again prepared questionnaire with 11 items, which was then administered to 300 volunteers.

Since the present tool is "self-assessment" type, the question of interrater variability was not considered.

Collection of Data and Data Entry

The volunteers who gave consent were then explained about their role in the study. Every volunteer was then provided with an *Agnibala* assessment tool, which included some preliminary information related to the individual to be filled in. After completion of the format, the calculation of scores was done. The data obtained were first entered in a web-based form to avoid data discrepancy during its entry, and subsequently was downloaded as a spreadsheet for further analysis. Blood samples were collected from all the volunteers for evaluating the lipid profile parameters in the department in the morning hours after the overnight fasting. The samples were assessed for lipid parameters using the biochemistry auto-analyzer.

Statistical Validation of Agnibala Assessment Tool

While entering the data, the following scores were given for each category of *Agni*: 1 = *Mandagni*, 2 = *Vishamagni*, 3 = *Samagni*, 4 = *Tikshnagni*. This was done because these categories of *Agni* represented a sequential spectrum ranging from diminution to

Table 2. Results of Analysis of Variance Applied to Compare the Mean Scores Obtained in Each Group for Each Question. The number of volunteers (n) present in each group was as follows: *Mandagni* = 40, *Vishamagni* = 70, *Samagni* = 164 and *Tikshnagni* = 26.

Question	Agnibala Group	Mean	Standard Deviation	p	Post Hoc Boneferroni Test Significant Pairs
Q1	<i>Mandagni</i>	1.65	0.949	<.001	All pairs
	<i>Vishamagni</i>	2.57	0.827		
	<i>Samagni</i>	2.90	0.550		
	<i>Tikshnagni</i>	3.92	0.272		
Q2	<i>Mandagni</i>	1.55	0.904	<.001	All pairs
	<i>Vishamagni</i>	2.37	0.871		
	<i>Samagni</i>	3.11	0.726		
	<i>Tikshnagni</i>	3.62	0.752		
Q3	<i>Mandagni</i>	1.60	0.955	<.001	All pairs
	<i>Vishamagni</i>	1.94	0.796		
	<i>Samagni</i>	2.32	0.767		
	<i>Tikshnagni</i>	3.08	1.017		
Q4	<i>Mandagni</i>	1.25	0.630	<.001	All pairs
	<i>Vishamagni</i>	2.31	0.753		
	<i>Samagni</i>	2.74	0.652		
	<i>Tikshnagni</i>	3.96	0.196		
Q5	<i>Mandagni</i>	1.50	0.877	<.001	All pairs
	<i>Vishamagni</i>	2.24	1.028		
	<i>Samagni</i>	2.52	0.916		
	<i>Tikshnagni</i>	3.65	0.846		
Q6	<i>Mandagni</i>	1.42	0.781	<.001	All pairs
	<i>Vishamagni</i>	2.10	0.935		
	<i>Samagni</i>	2.49	0.994		
	<i>Tikshnagni</i>	3.69	0.788		
Q7	<i>Mandagni</i>	1.45	0.846	<.001	All except <i>Mandagni</i> vs <i>Tikshnagni</i>
	<i>Vishamagni</i>	2.03	0.538		
	<i>Samagni</i>	2.24	0.914		
	<i>Tikshnagni</i>	2.73	0.778		
Q8	<i>Mandagni</i>	2.52	0.640	<.001	All except <i>Mandagni</i> vs <i>Tikshnagni</i>
	<i>Vishamagni</i>	2.27	0.563		
	<i>Samagni</i>	2.76	0.481		
	<i>Tikshnagni</i>	2.62	0.637		
Q9	<i>Mandagni</i>	2.30	0.853	<.001	All except <i>Mandagni</i> vs <i>Vishamagni</i>
	<i>Vishamagni</i>	2.23	0.663		
	<i>Samagni</i>	2.77	0.546		
	<i>Tikshnagni</i>	2.77	0.908		
Q10	<i>Mandagni</i>	2.05	0.986	<.001	All except <i>Mandagni</i> vs <i>Vishamagni</i>
	<i>Vishamagni</i>	2.17	0.761		
	<i>Samagni</i>	2.62	0.650		
	<i>Tikshnagni</i>	3.23	0.951		
Q11	<i>Mandagni</i>	2.50	0.784	<.001	All except <i>Mandagni</i> vs <i>Vishamagni</i>
	<i>Vishamagni</i>	2.61	0.822		
	<i>Samagni</i>	2.85	0.688		
	<i>Tikshnagni</i>	3.38	0.697		

accentuation. After the data entry, the mean and standard deviation of scores obtained for each item were calculated for each type of *Agnibala*. These means were compared applying 1-way analysis of variance based on the category of *Agnibala*. As Table 2 suggests, the differences between the mean scores were statistically significant from each other ($P < .001$) in almost all cases, indicating that each item in the tool is efficient in differentiating each category of *Agni*.

Table 3. Comparison of the Mean Total Agni Scores Among All Categories of *Agnibala*. The number of volunteers (n) present in each group was as follows: *Mandagni* = 40, *Vishamagni* = 70, *Samagni* = 164 and *Tikshnagni* = 26.

<i>Agnibala</i>	Mean	Standard Deviation	<i>p</i>	Post Hoc Boneferroni Test Significant Pairs
<i>Mandagni</i>	19.8	2.43	<.001	All pairs
<i>Vishamagni</i>	24.85	2.53		
<i>Samagni</i>	29.33	2.69		
<i>Tikshnagni</i>	36.65	2.22		

Test for the Reliability of the Tool

The reliability of the questionnaire was again done using descriptive analysis and by employing Cronbach's alpha that indicates good internal consistency of the items in the scale. A low value of alpha indicates poor interrelatedness between items or heterogeneous construct. In the study a high value of Cronbach's alpha, that is, .73 was obtained for overall scale. A value of Cronbach's alpha greater than .7 is taken as acceptable for validation of questionnaire.^{17,18} Furthermore, removing any of the items did not substantially increase the value of Cronbach's alpha and therefore, all the items were retained in the questionnaire.

We further calculated the total *Agnibala* scores obtained by each individual and compared the mean total *Agni* scores among different categories of *Agnibala* by applying 1-way analysis of variance. As Table 3 suggests, the differences between the mean scores in all groups were statistically highly significant ($P < .001$) indicating once again that the tool is efficient in differentiating the different categories of *Agnibala*.

Verification of the Tool for Its Clinical Utility

After satisfactory statistical validation, we further tried to verify the practical utility of the newly developed tool by recording serum lipid parameters of all the volunteers. We chose lipid parameters because they have been shown to have interindividual variations.

Table 4 depicts the variation in lipid profile parameters according to different categories of *Agnibala*. It may be noted that the mean total cholesterol levels showed statistically significant difference ($P < .05$) between *Mandagni* (192.83 ± 33.53) and *Tikshnagni* (222.53 ± 45.89) groups. The mean low-density lipoprotein/high-density lipoprotein values also showed a similar variation ($P < .05$) and the significant differences were observed between *Vishamagni* (2.04 ± 0.63) and *Samagni* (2.35 ± 0.81) groups. The cholesterol ratio was calculated through dividing the total cholesterol by high-density lipoprotein. The mean cholesterol ratio too showed a statistically significant variation according to the *Agnibala* groups ($P < .05$), and these differences were significant between *Vishamagni* (3.24 ± 0.812) and *Samagni* (3.65 ± 0.96) groups.

Discussion

The objective of the present study was to develop a self-assessment tool to evaluate *Agnibala*, to test the tool for its validity and reliability and also to verify its relevance in the

Table 4. Depiction of the Variation in Different Lipid Parameters According to *Agnibala*. The number of volunteers (n) present in each group was as follows: *Mandagni* = 40, *Vishamagni* = 70, *Samagni* = 164 and *Tikshnagni* = 26.

Biochemical Parameters	<i>Agnibala</i>	Mean	Standard Deviation	<i>p</i>	Post Hoc Boneferroni Test Significant Pairs
Serum triglyceride (mg/dL)	<i>Mandagni</i>	147.53	45.94	0.218	—
	<i>Vishamagni</i>	136.22	45.98		
	<i>Samagni</i>	149.96	46.02		
	<i>Tikshnagni</i>	144.5	45.22		
Total cholesterol (mg/dL)	<i>Mandagni</i>	192.83	33.56	0.013	<i>Mandagni</i> vs <i>Tikshnagni</i>
	<i>Vishamagni</i>	198.48	42.54		
	<i>Samagni</i>	209.40	44.04		
	<i>Tikshnagni</i>	222.53	45.89		
LDL (mg/dL)	<i>Mandagni</i>	120.07	26.62	0.065	—
	<i>Vishamagni</i>	123.42	30.16		
	<i>Samagni</i>	132.22	31.18		
	<i>Tikshnagni</i>	129.36	35.43		
HDL (mg/dL)	<i>Mandagni</i>	61.62	18.33	0.125	—
	<i>Vishamagni</i>	64.37	19.23		
	<i>Samagni</i>	60.25	17.26		
	<i>Tikshnagni</i>	68.08	17.99		
LDL/HDL	<i>Mandagni</i>	2.07	0.65	0.004	<i>Vishamagni</i> vs <i>Samagni</i>
	<i>Vishamagni</i>	2.04	0.63		
	<i>Samagni</i>	2.35	0.81		
	<i>Tikshnagni</i>	1.98	0.57		
Cholesterol ratio	<i>Mandagni</i>	3.38	1.066	0.015	<i>Vishamagni</i> vs <i>Samagni</i>
	<i>Vishamagni</i>	3.24	0.812		
	<i>Samagni</i>	3.65	0.968		
	<i>Tikshnagni</i>	3.42	0.966		
VLDL (mg/dL)	<i>Mandagni</i>	29.50	9.18	0.218	—
	<i>Vishamagni</i>	27.24	9.19		
	<i>Samagni</i>	29.99	9.20		
	<i>Tikshnagni</i>	28.09	9.04		

Abbreviations: HDL, high-density lipoprotein; LDL, low-density lipoprotein; VLDL, very-low-density lipoprotein.

clinical setup. The intention behind such a proposal was to construct a tool based on the classical descriptions found in Ayurveda literature while simultaneously rendering them practical and relevant in the context of routine clinical practice. Therefore, while generating the items, common clinical sense and experience was taken as benchmark by consulting experienced Ayurveda clinicians and academicians and hence, the language of these items was kept as simple as possible. As the results of the study show, the present tool may be said to be reasonably valid and reliable based on statistical analysis. Furthermore, it may also be considered "clinically applicable" based on the observations we have recorded in the context of the parameters related to lipid profile.

Grover et al¹⁹ analyzed the relation between low-density lipoprotein and high-density lipoprotein cholesterol levels to predict the risk of future coronary events. Their study indicates that the benefits of increasing high-density lipoprotein are strongest among the people with high levels of low-density

lipoprotein. Conversely, the benefits of decreasing low-density lipoprotein are greatest among those with low levels of high-density lipoprotein.¹⁹ A review by Millán et al²⁰ on physiological significance of lipoprotein ratio and its clinical usefulness in cardiovascular prevention concludes that total cholesterol/high-density lipoprotein cholesterol ratio and low-density lipoprotein/high-density lipoprotein cholesterol ratio are risk indicators with greater predictive value than isolated parameters used independently. Another review by Fernandez et al²¹ concluded that low-density lipoprotein/high-density lipoprotein ratio could be a valuable tool to evaluate coronary heart disease risk.

In this context, the results of our study assume importance. Significant variations were noticed in mean total cholesterol among *Mandagni* and *Tikshnagni* groups. The mean low-density lipoprotein/high-density lipoprotein values showed a statistically significant variation between *Vishamagni* and *Samagni* groups. The mean cholesterol ratio too showed a statistically significant variation between *Vishamagni* and *Samagni* groups.

Considering all this, we suggest a possibility that the present tool may be useful in screening the individuals for further biochemical evaluation. However, this needs further evaluation in a larger sample. If such a possibility is proven, the tool may be disseminated among general public so that they may be encouraged to evaluate their *Agnibala* and can be motivated to go for the assessment of biochemical parameters to know their health status and susceptibility for specific conditions. Furthermore, a few simple diet-based, behavioral, and herb-based interventions can be planned²² to make the *Vishamagni*, *Tikshnagni*, and *Mandagni* states return to *Samagni*, which is the ideal state.

Authors' Note

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Author Contributions

AS contributed toward design, literature search, data acquisition, data analysis, manuscript preparation, manuscript editing, and manuscript review. GS contributed toward data acquisition, data analysis, statistical analysis, manuscript preparation, manuscript editing, and manuscript review. KP contributed toward concepts, design, definition of intellectual content, literature search, data analysis, statistical analysis, manuscript preparation, manuscript editing, manuscript review, and agrees to act as guarantor. SG contributed toward concepts, design, definition of intellectual content, literature search, statistical analysis, manuscript preparation, manuscript editing, manuscript review, and agrees to act as guarantor.

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Ethical Approval

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References

- Pandey K, Chaturvedi G, eds. *Grahanidoshashikitsa, Charaka Samhita*. Varanasi, India: Chaukambha Bharati Academy; 2004: 452. Reprint.
- Pandey K, Chaturvedi G, eds. *Grahanidoshashikitsa, Charaka Samhita*. Varanasi, India: Chaukambha Bharati Academy; 2004: 459. Reprint
- Pandey K, Chaturvedi G, eds. *Grahanidoshashikitsa, Charaka Samhita*. Varanasi, India: Chaukambha Bharati Academy; 2004: 454. Reprint.
- Kunte AM, Navare KRS, eds. *Doshavigyaniya, Ashtanga Hridaya. Commentary of Arundatta and Hemadri*. 9th ed. Varanasi, India: Chaukambha Orientalia; 2005:188.
- Patwardhan K. *Human Physiology in Ayurveda* (Jiakrishnadas Series no. 134). Varanasi, India: Chaukambha Orientalia; 2008: 27-31.
- Pandey K, Chaturvedi G, eds. *Roganikavimana, Charaka Samhita*. Varanasi, India: Chaukambha Bharati Academy; 2005: 719. Reprint.
- Dwarikanath C. *Introduction to Kayachikitsa*. 3rd ed. Varanasi, India: Chaukambha Orientalia; 1996:55
- Pandey K, Chaturvedi G, eds. *Matrashitiyaadhyaya, Charaka Samhita*. Varanasi, India: Chaukambha Bharati Academy; 2005: 102. Reprint.
- Pandey K, Chaturvedi G, eds. *Apasmarnidana, Charaka Samhita*. Varanasi, India: Chaukambha Bharati Academy; 2005:668. Reprint.
- Murthy KRS, ed. *Grahnidoshashikitsitam, Ashtanga Sangraha*. Vol. II. Varanasi, India: Chaukambha Orientalia; 2009:188.
- Patil VC, Baghel MS, Thakar AB. *Assessment of Agni (digestive function) and Koshtha (bowel movement with special reference to Abhyantara snehana (internal oleation))*. *Ancient Sci Life*. 2008; 28:26-28.
- Eswaran HT, Kavita MB, Tripathy TB, Shivakumar. *Formation and validation of questionnaire to assess Jatharagni*. *Ancient Sci Life*. 2015;34:203-209. doi:10.4103/0257-7941.159829.
- Pandey R, Tripathi NS. *Correlative Study of Agnibala and Prakriti in Different Seasons in Young Healthy Individuals With Special Reference to Thyroid Hormones* [master's thesis]. Varanasi, India: Banaras Hindu University: Varanasi; 2014.

14. Pandey K, Chaturvedi G. eds. *Rogabhishakjitiyavimana, Charaka Samhita*. Varanasi, India: Chaukambha Bharati Academy; 2005: 770. Reprint.
15. Saw SM, Ng TP. The design and assessment of questionnaires in clinical research. *Singapore Med J*. 2001;42:131-135.
16. Rastogi S. Development and validation of a Prototype Prakriti Analysis Tool (PPAT): inferences from a pilot study. *Ayu*. 2012;33:209-218. doi:10.4103/0974-8520.105240.
17. Bland JM, Altman DG. Statistics notes: Cronbach's alpha. *Br Med J*. 1997;314:572.
18. Streiner D, Norman G. *Health Measurement Scales: A Practical Guide to Their Use*. 2nd ed. Oxford, England: Oxford University Press; 1995.
19. Grover SA, Dorais M, Coupal L. Improving the prediction of cardiovascular risk: interaction between LDL and HDL cholesterol. *Epidemiology*. 2003;14:315-320.
20. Millán J, Pintó X, Muñoz A, et al. Lipoprotein ratios: physiological significance and clinical usefulness in cardiovascular prevention. *Vasc Health Risk Manag*. 2009;5: 757-765.
21. Fernandez ML, Webb D. The LDL to HDL cholesterol ratio as a valuable tool to evaluate coronary heart disease risk. *J Am Coll Nutr*. 2008;27:1-5.
22. Divya K, Tripathi JS, Tiwari SK. Exploring novel concept of Agni and its clinical relevance. *Altern Integr Med*. 2003;2:140. doi:10.4172/2327-5162.1000140.