## *Original Research Article*

# The status of *Dhātusāratā* (the level of tissue excellence) and its association with*Deha prakṛti*(body constitution)in patients with Chronic Kidney Disease (CKD) – Western Province, Sri Lanka




**ABSTRACT**

**Aims:** The study was planned to assess the status of *Dhātusāratā* (the level of tissue excellence) and its association with *Deha prakṛti* (body constitution) in patients with Chronic Kidney Disease (CKD) – Western Province, Sri Lanka

**Study design:**A prospective observational case – control study

**Place and Duration of Study:**University Nephrology Clinic at the National Hospital, Sri Lanka and the Renal Clinic at Bandaranaike Memorial Āyurveda Research Institute, Nawinna, Maharagama, Sri Lanka. From July 2021 – July 2022

**Methodology:**113 patientswith a diagnosis of CKD and 122 healthy volunteers residing in the Western Province were enrolledfor the study.*Dhātusāratā* status of *Rasa* to *Sattva* was assessed using a standardized and validated questionnaire and ĀyuSoft software was used to assess the type of *Deha prakṛti* of the research participants. Data analysis was done by using Microsoft Excel 2007 version and appropriate statistical software.

**Results:**The study results revealed that a majority between 43 – 50 % of CKD patients exhibited a predominance of *Madhyama sāra* status (moderate level of tissue excellence) for*Rasa*, *Rakta* and *Māṃsadhātu*. A considerable percentage (over 60%) of patients displayed *Avara sāra* status (inferior or lower level of tissue excellence) in their subsequent *dhātu*(including *Sattva*), commencing from *Asthi.*Compared to the CKD patients, the number

of healthy individuals/ controls with*Pravara sāra* status (superior level of tissue excellence) of each *dhātu*and *Sattva*is substantially high. None of the healthy individuals had *Avara sāra* status of *Dhātu*nor *Sattva*. Furthermore, it was observed that the mean percentage scores of all*dhātu*(commencing from Rasa to *Śukradhātu*)and *Sattva sāratā*were significantly differed according to CKD stages under a 5% level of significance. It was alsoobserved that the status of *Dhātu*commencing fromRasa to *Śukradhātu*and *Sattvasāratā*was significantly associated with the *Deha prakṛti* types in CKD patients – Western Province, Sri Lanka, under a 5 % level of significance.

**Conclusion:**It can be concludedthat *Dhātusāratā*status including *Sattva*depends on the type of *Deha prakṛti*in CKD patients and *Sāra*status of each *Dhātu*including *Sattva* declines from *Pravara sāra*to *Avara sāra*as the disease progresses. In addition, the CKD patients with *Kapha pradhānaprakṛti* type can be considered to have the maximum *Deha bala*whereasthose with*Pitta* and *Vātapradhānaprakṛti*types exhibit average and lowest levels of *Deha bala*respectively.

*Keywords:* Association, CKD,*Dhātusāratā, Deha prakṛti*

## 1. INTRODUCTION

At present, Chronic Kidney Disease (CKD) has emerged as a significant global health concern, even in Sri Lanka. Based on the findings of the Global Burden of Disease Study conducted in 2015, CKD is identified as the twelfth leading cause of mortality, accounting for around 1.1 million deaths worldwide. The study additionally demonstrated that mortality associated withCKD experienced a substantial increase of 31.7% between 2005 and 2015, with a notable upward trend [1]. In terms of CKD prevalence in Sri Lanka, a recent cross-sectional epidemiologic study conducted in the Western Province revealed a CKD prevalence of 15% among adults[2]. Additionally, a study based on the experience of a tertiary care center among the population of Sri Lanka found that the Western Province had

the highest percentage of CKD patients, accounting for 68.5% of all reported cases[3].Furthermore,according to theDemographic and Health Survey Report released by the Department of Census and Statistics, Sri Lanka in 2016, the prevalence ofCKD in the Western Province, which includes the districts of Colombo, Gampaha, and Kalutara, is at 1% andthis percentage corresponds to a total of 60,230 individuals affected by CKD in the aforementioned region. Theabove data indicates that the Western Province exhibits the greatest prevalence ofCKD in comparison to the other provinces within the country[4].However,it was also reported that apart from the Western Province, there was a higher prevalence of CKD in the Northern and North Central Provincesin comparison to the Central and Uva Provinces in Sri Lanka [5]. However, the aforementioned facts emphasized the global impact of CKD, including its effects on the Sri Lankan population.

According to Western medicine, Kidney damage that involves structural or functional abnormalities of kidneys other than decreased GFR, present for longer than three months, with health implications, is defined as CKD [6]and staging of CKD had been done into a grade (stages) 1 to 5 according to the severity, based on the National Kidney Disease Outcomes Quality Initiative (KDOQI) criteria [7]. Although the early stages of CKD are asymptomatic [8], it is very challenging to diagnose the disease in its early stages. As the identification of the disease takes time, it may badly affect the disease prognosis and management. This would be the closest explanation for why CKD has become one of the most hazardous health impacts worldwide. Moreover, the aforementioned facts regarding the increased incidence and prevalence rate of CKD have already proven that there is still no identification of a permanent cure or solution instead of renal replacement therapy for disease management. This remains a tremendous challenge for the healthcare system of the country, especially the Western and Āyurveda medical systems. Hence, it is imperative to ascertain integrative and novel strategies that combine Āyurveda and Western therapy in order to effectively address the disease. The field of Āyurveda, which pertains to the study of life sciences, benefits from a rich array of concepts, theories, and hypotheses. These

elements are important in establishing effective strategies for the prevention and management of chronic diseases and thus contribute significantly to the field of healthcare.

As an entry to approach the disease, the study focus has been considered the fundamental theories described in the Āyurveda medical system as they provide the foundation for new beginnings and enhance the opportunities to explore optimal solutions for even the most difficult problematic situations. Accordingly, the study focused on the concepts of *Dhātusāratā*(tissue excellence) and *Deha prakṛti* (body constitution)mentioned in Āyurveda science and the associations between them which can be applied effectively in the prevention and management of CKD. The effort to emphasize the associations between the chosen concepts would definitely lend a hand to facilitating the effective implementation of strategies for the prevention and management of CKD.

The concept of "*Dhātusāra"* is one of the fundamental theories mentioned under "*Daśavidhaāthuraparīkṣa*" which offers essential facts on the healthy – unhealthy status of an individual's body tissues and knowing the *Sāra* status of every *Dhātu* of the body would provide enormous support in the prevention and management of diseases. *Sāra*is an essence of *Dhātu*(tissues) with excellent quality and the qualitative assessment of *Dhātu* is known as *"Sāraparīkṣā"*. Based on the excellence of *Saptadhātu (Rasa* - plasma*, Rakta* - blood*, Māṃsa* - muscles*, Medas* - fat*, Asthi* - bones*, Majjā* – bone marrow*, Śukra* – sperms/ova*)* and *Sattva (*mental status*)*, eight types of *Sāra* have been explained by *Acārya*Caraka in CarakaSaṃhitāVimānasthāna8/102-110. Moreover, CarakaSaṃhitāVimānasthāna8/114 indicated that the concept of *Dhātusāratā*primarily can be used as an imperative parameter to determine the strength of an individual, indicating whether they are healthy or diseased [9]. Simply, it measures the "*Bala pramāṇa*" (strength) of an individualaccording to Āyurveda and also, *Sāra* status of *Dhātu* has been classified as *Pravara* (persons having a superior level ofthe essence), *Madhyama* (persons having a moderate level of the essence) and *Avara sāra*(persons having less or no essence) in CarakaSaṃhitāVimānasthāna8/111-113. An assessment of "*Bala pramāṇa*" (strength) has

importance in the context of applying medications to the patients as quoted in CarakaSaṃhitāKalpasthāna12/57, *Madhyama* (average) and *Hīna/Avara* (inferior) *bala* persons should be given *Madhyama* and *Mṛdubalaauṣada*(medium and mild drugs) respectively as medium and mild drugs are defective for strong persons and they do not eliminate the entire impurity.*Auṣadhakāla*(time schedule for drug administration) also depends on the *Bala pramāna*of the patient. As specified in CarakaSaṃhitāCikitsāsthāna30/296-297 *Balwanarogī*(patients who are strong in nature) are given medicine by skipping breakfast or without food early in the morning. *Durbala rogī* (patients who are weak innature) are instructed to take medicine with a light, wholesome diet[9]. Accordingly, when it comes to disease management, physicians must select the appropriate method of treatment regime according to the *Bala pramāna* of the patient.

Given the aforementioned information, it is imperative to evaluate the *Dhātusāratā* in an individual afflicted with a disease in order to make decisions regardingdisease diagnosis – prognostication, recommend appropriate treatmentregimes and effectively manage persistent conditions such as CKD. Significantly as the chronicity of the disease will definitely affect the *Dhātu*of that patient, it is essential to assess the status of the *Dhātusāratā* of that particular patient before commencing the treatments. Unlike in the genetic design, i.e., *Prakṛti*of the body, *Sāratā* status of *Dhātu* can be changed every moment.

*Prakṛti*which isalways referred to as "*Deha prakṛti"* as covered in CarakaSaṃhitāSūthrasthāna7/43 [9], is one of another imperative and practical evidence - based concept mentioned under *Daśavidhaāthuraparīkṣā* (ten - fold examination of the patient) in CarakaSaṃhitāVimānasthāna8/94 [9]. As mentioned inSushruta SaṃhitāŚārīrasthāna4/74,*Prakṛti* is also known as the psychosomatic constitution of an individual, which remains invariant throughout the lifespan [10]. It reflects the physical, physiological and psychological qualities of that individual. According to *Acārya*Cakrapāṇidatta, *Prakṛti*means "Nature" (*swabhāva*) [11] and it reflects the natural state of human beings at an anatomical, physiological, and psychological level [12].*Deha*

*prakṛti* is determined based on the dominance of any single or a combination of two or three *Doṣā* called *Vāta, Pitta* and *Kapha* at the time of conception [10]. The assessment of *Prakṛti*holds significant importance in the patient examination protocol outlined in the Āyurveda medical practice. It will basically facilitate early detection, forecast susceptibility to diseases, prognosticate disease progression, determine optimal treatment protocols and potentially result in significant reductions in mortality rates. Hence, the implementation of the concept of *Deha prakṛti* in the prevention and management of CKD would represent an important step forward in the field of healthcare.

Therefore, examining the type of *Deha prakṛti* is also important as determining the *"Sāra"* status of *Dhātu* and assessment of their applied aspects, especially the association of the above two aspects will give immense support in effectively managing chronic diseases such as CKD. If there is an association, the treatment regimes, including dietary and behavioral patterns, can be planned according to the type of *Deha prakṛti* and the status of *Dhātusāratā* of that particular CKD patient. Moreover, the tissues that may be prone to become *Avara sāra* status from *Madyamasāra* or *Pravara sāra* status could be prevented by making appropriate clinical decisions as per the patient's *Sāra*status and *Deha prakṛti*.

The previous studies regarding the status of *Dhātusāratā* and its association with*Deha prakṛti*of patients with CKD have not been found in the existing literature. In this circumstance, examining "*Sāra"* status and its association with *Deha prakṛti* would serve as a highly supportive tool in the prevention and management of patients with CKD. Therefore, the study has focusedon assessing the *Sāra*status of *Saptadhātu* and *Sattva* as well as its association with *Deha prakṛti*types in CKD patients in Western Province, Sri Lanka.

## 2. METHODOLOGY

**2.1Study Design** - Prospective Case – Control Observational Study

**2.2 Study population** - The study focused on two groups. i.e., patients withCKD and healthy controls. 113 patients were selected from the University Nephrology Clinic at the National

Hospital, Sri Lanka and the Renal Clinic at Bandaranaike Memorial Āyurveda Research Institute, Nawinna, Maharagama. The Western Province residents with a diagnosis of CKD were enrolled. 122 healthy volunteers residing in Western Province, who accompanied the CKD patientsto the above clinics were considered as controls.

**2.3 Inclusion and exclusion criteria used to select the research participants**

Patients between 18 and 80 years of age who have been attending the aforementioned two clinics and have a documented diagnosis of CKD were included if they had either an estimated Glomerular Filtration Rate (eGFR) below 60 ml/min/1.73m$^2$ or proteinuria irrespective of eGFR. The eGFR calculation was based on the CKD – EPI formula[13]. CKD Patients, below 18 years and above 80 years, who are suffering from Human Immunodeficiency Virus (HIV) infection, Malignant disorders, Psychiatric disorders, Dementia, etc., who had immunotherapy for the last six months, who had chemotherapy for the last two years, females who are pregnant or breastfeeding, who unwilling to give informed consent, patients with Acute Kidney Injury (AKI) were excluded from the study.

Healthy controls/individuals were selected based on their clinical history as reported by them and physical examination. Baseline investigations including serum creatinine were done to confirm that they were healthy.

**2.4 Data collection**

**2.4.1 Assessment of *Deha prakṛti* (body constitution) types of the research participants**

ĀyuSoft software which is in the form of a standardized and validated questionnaire was used to assess the types of *Deha prakṛti*(body constitution) of the research participants[14], [15], [16], [17], [18], [19].The assessment of *Deha prakṛti* was executed using weightage configuration in ĀyuSoft. Data were collected only once from each participant during the study period via direct interview by the principal investigator. The type of *Deha prakṛti*of each participant was determined automatically byĀyuSoftaccording to the percentage of predominant *Doṣa*.The research participants were divided into four groups according to the types of *Deha prakṛti*as follows.

1. *Vātapradhānaprakṛti*2.*Pitta pradhānaprakṛti*

3. *Kaphapradhānaprakṛti*4.*Sama doṣajaprakṛti*

**2.4.2 Assessment of *Dhātusāratā* status (the level of tissue excellence) of the research participants**

The *Dhātusāratā*status of the research participants was assessed using the questionnaire designed and published in the study "Weighted mean: A possible method to express overall *Dhātusāratā*" by Gunawat et al. (2015) [20]. It expresses an individual's overall *Dhātusāratā*based on weighted mean scores. This questionnaire provides the percentage of *Sāratā*statusof each *Dhātu*of an individual separately.

The selected questionnaire was designed only to assess the *Dhātusāratā* from *Rasa dhātu* to *Śukradhātu*. However, *Aṣtavidhasāraparīkṣā* includes another component. i.e., *Sattva sāra*(quality of mind). Therefore, to assess the *Sattva sāratā*of the participants, the questions were prepared according to the characteristics of *Sattva sāra* in an individual given in CS.Vi.8/110 [9]and SS.Sū.35/16 [10]. The newly designed portion of the questionnaire to assess *Sattva sāratā* was pre - tested.

**2.4.2.1Criteria for determination of the *Sāra* status of each *Dhātu* (the level of tissue excellence in each *Dhātu*) of research participants**

At the end of the questionnaire, each participant received a calculated percentage of each *Dhātusāratā* (tissue excellence) separately. That was considered as the *Sāra* percentage of each *Dhātu*.The status of each *Dhātusāratā*(tissue excellence) is then divided into three equal categories[20]according to the percentages as follows.

- If the calculated *Sāra* percentage is between 0 – 33.3%, that *Dhātu*was considered as *Avara sāra*
- If the calculated *Sāra* percentage is between 33.4 – 66.6 %, that *Dhātu*was considered as *Madhyama sāra*
- If the calculated *Sāra*percentage is between 66.7 – 100 %, that *Dhātu*was considered

as *Pravara sāra*

(*Pravarasāra* status indicates the superior/optimal level of tissue excellence, *Madhyamasāra* status indicates the moderate/medium level of tissue excellence and *Avara sāra* status indicates the inferior/ lower level of tissue excellence)

### 2.5 Data analysis

Microsoft Excel 2007 version and appropriate statistical analysis software were used to analyze the collected data. Data analysis included descriptive statistics, correlation analysis, comparison of two medians (Mann – Whitney U test), comparison of multiple medians (Kruskal Wallis test) and associations between categorical variables (Chi - square test). Tables and bar charts were used to demonstrate how the status of *Dhātusāratā* varied according to disease stages as well as the distribution pattern of participants based on each *Dhātusāratā status*. The *Sama doṣajaprakṛti* type was removed from the *Deha prakṛti* classification only for the statistical analysis related to the associations between *Dhātusāratā* status and the types of *Deha prakṛti* in CKD patientsdue to the underrepresentation of participants. Accordingly, the total number of CKD patients analyzed for associations was 112 and the number of healthy controls/individuals was 119.

## 3. RESULTS AND DISCUSSION

### 3.1 Distribution pattern of CKD patients and healthy controls/individuals according to the status of*Dhātusāratā* (tissue excellence)

Table 1 summarizes the count and percentages of CKD patients as well as the healthy controls/individuals according to the classification done to clarify their status of *Dhātusāratā,* namely *Pravara sāra*(superior/ optimal level), *Madhyama sāra* (moderate/ medium level) and *Avara sāra* (inferior/ lower level). Additionally, it demonstrates how the percentage of participants varies according to the *Sāra* status of each *Dhātu,* including *Sattva* (irrespective of the type of *Deha prakṛti* and CKD stages).

Table1: The distribution pattern of CKD patients and healthy controls/individuals according to *Dhātusāratā* (tissue excellence) status – irrespective of the type of *Deha prakṛti* (body constitution) and disease stages

| Types of *DhātuDhātu sāratā* | The status of | CKD patients (n = 113) | | Healthy controls/ Individuals (n = 122) | |
|---|---|---|---|---|---|
| | | Count | Percentage | Count | Percentage |
| *Rasa dhātu* (represents the skin) | *Avara* | 19 | 16.8 % | 0 | 0 % |
| | *Madhyama* | 56 | 49.6 % | 2 | 1.6% |
| | *Pravara* | 38 | 33.6 % | 120 | 98.4% |
| | Total | 113 | 100% | 122 | 100% |
| *Rakta dhātu*(blood tissue) | *Avara* | 20 | 17.7 % | 0 | 0 % |
| | *Madyama* | 55 | 48.7 % | 0 | 0 % |
| | *Pravara* | 38 | 33.6 % | 122 | 100 % |
| | Total | 113 | 100% | 122 | 100% |
| *Māṃsadhātu* (muscle tissue) | *Avara* | 26 | 23 % | 0 | 0 % |
| | *Madhyama* | 49 | 43.4 % | 03 | 2.5 % |
| | *Pravara* | 38 | 33.6 % | 119 | 97.5% |
| | Total | 113 | 100 % | 122 | 100% |
| *Medas dhātu* (fat tissue) | *Avara* | 45 | 39.8 % | 0 | 0% |
| | *Madhyama* | 38 | 33.6 % | 08 | 6.5% |
| | *Pravara* | 30 | 26.5 % | 114 | 93.4% |
| | Total | 113 | 100% | 122 | 100% |
| *Asthidhātu* (bone tissues) | *Avara* | 74 | 65.5% | 0 | 0% |
| | *Madhyama* | 14 | 12.4% | 18 | 14.8% |
| | *Pravara* | 25 | 22.1% | 104 | 85.2% |
| | Total | 113 | 100% | 122 | 100% |
| *Majjjādhātu* (bone marrow tissues) | *Avara* | 75 | 66.4% | 0 | 0% |
| | *Madyama* | 12 | 10.6% | 12 | 9.8% |
| | *Pravara* | 26 | 23% | 110 | 90.2% |
| | Total | 113 | 100% | 122 | 100% |
| *Śukradhātu* (reproductive tissue - | *Avara* | 72 | 63.7 % | 0 | 0 % |
| | *Madhyama* | 16 | 14.2% | 17 | 13.9% |
| | *Pravara* | 25 | 22.1 % | 105 | 86.1% |

| | | | | | |
|---|---|---|---|---|---|
| semen/ovum) | Total | 113 | 100% | 122 | 100% |
| *Sattva* (mind) | *Avara* | 79 | 70 % | 0 | 0 % |
| | *Madhyama* | 25 | 22.1 % | 0 | 0 % |
| | *Pravara* | 09 | 8 % | 122 | 100% |
| | Total | 113 | 100% | 122 | 100% |

Table1 demonstrates how the number of CKD patients and healthy controls/individuals varies with the status of *Dhātusāratā*, i.e., *Pravara*, *Madhyama* and *Avara*. The study results revealed that a majority of patients with CKD exhibited a predominance of *Madhyama sāra* status for*Rasa*, *Rakta* and *Māṃsadhātu*. Accordingly, 50%, 49% and 43% of patients had *Madhyama sāra* status of *Rasa*, *Rakta* and *Māṃsadhātu* respectively. A limited proportion (below 23%) of CKD patients exhibited the presence of *Avara sāra* initial *dhātu*, namely *Rasa*, *Rakta* and *Māṃsa*. Nevertheless, it was noted that a considerable percentage (over 64%) of patients displayed *Avara sāra* status in their subsequent *dhātu*, commencing from *Asthi*. There were patients exhibiting *Pravara sāra*for all*dhātu* including *Sattva* although their prevalence was relatively low (below 33.6%). Furthermore, the proportion of patients demonstrating *Pravara sāradhātu* exhibited a declining trend subsequent to the *Māṃsadhātu*while the percentages of patients with *Pravarasārarasa*, *Rakta* and *Māṃsadhātu* remained stable at 33.6%. The above scenario is well illustrated with the percentages in Figure 1 below.

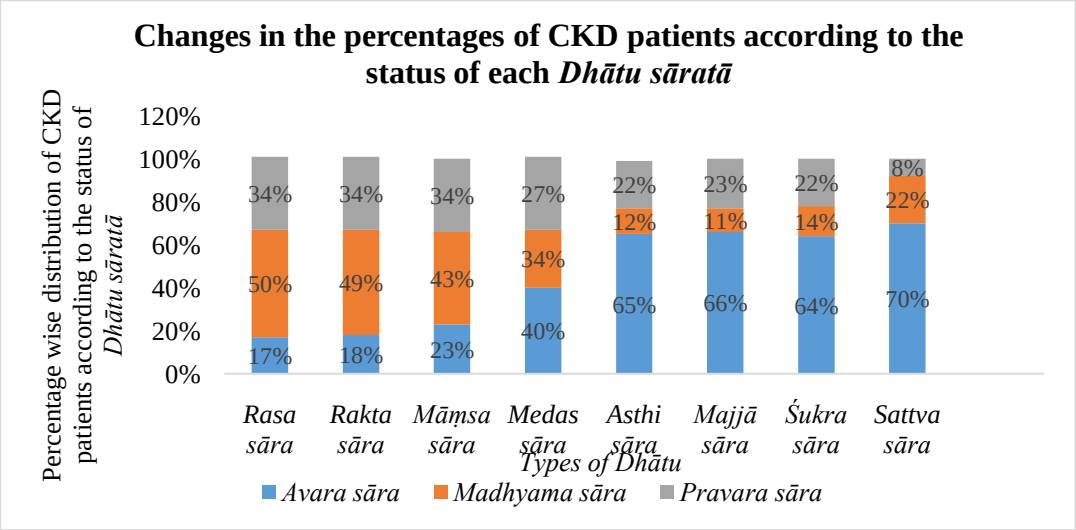


Figure 1: Changes in the percentages of Chronic Kidney Disease (CKD) patients according to the status of each *Dhātusāratā*(tissue excellence) (n = 113)

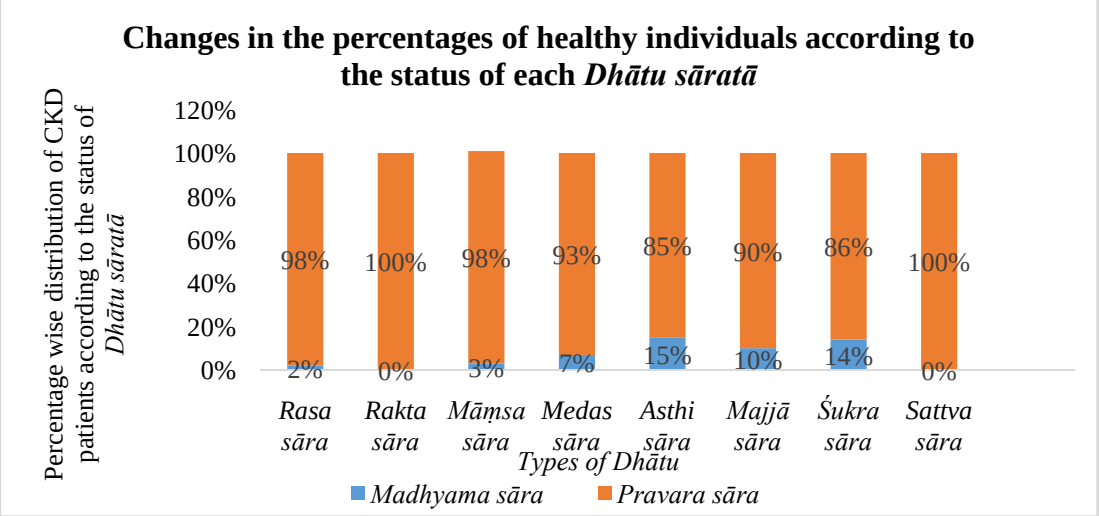


Figure 2: Changes in the percentages of healthy individuals according to the status of each *Dhātusāratā*(tissue excellence related to each *Dhātu*) (n = 122)

Figure 2 depicts how the percentage of healthy controls/ individuals varies according to the *Sāra* status of each *Dhātu*(tissue excellence related to each *Dhātu*).

Compared to the CKD patients, the number of healthy controls/ individuals with *Pravara sāra* status of each *dhātu* is substantially high. For instance, 100% of healthy controls/ individuals

had *Pravara sāra* status of *Raktadhātu* and *Sattva*, while nearly 98% had *Pravara sāra* status of *Rasa* and *Māṃsadhātu*. Among all the healthy controls/ individuals, 93 %, 85 %, 90 % and 86 % had *Pravara sāra* status of *Medas*, *Asthi*, *Majjā* and *Śukradhātu*, respectively. None of the healthy controls/individuals had *Avara sāra* status of *Dhātu*nor *Sattva*. However, there was a low number of healthy controls/ individuals who held the *Madhyama sāra* status of *Dhātu*except for *Rakta dhātu* and *Sattva*whose status is at Pravara in 100% of healthy controls/ individuals.

**3.2Stage - wise *Dhātusāratā* (tissue excellence) status based on *Dhātusāratā* mean percentage score (mean percentage score related to each tissue excellence)in CKD patients and healthy controls/ individuals**

Table 2 illustrates how the status of each *Dhātusāratā*of CKD patients changes according to the stages of the disease and how the status of each *Dhātusāratā*varies from *Rasa dhātu* to *Sattva* in healthy controls/ individuals.

Table 2: Stage – wise *Dhātusāratā*(tissue excellence) statusin CKD patients and healthy controls/ individuals based on *Dhātusāratā*mean percentage score (mean percentage score of each tissue excellence)

| Name of the *Dhātu* | Status of each *Dhātusāratā* in CKD patients based on *Dhātusāratā*mean percentage score and CKD stages (n = 113) | | | | | Status of *Dhātusāratā*in Healthy Individuals based on the mean percentage score (n=122) |
|---|---|---|---|---|---|---|
| | Stage 1 | Stage 2 | Stage 3 | Stage 4 | Stage 5 | |
| *Rasa* (represents the skin) | 94 % *Pravara* | 85.9% *Pravara* | 75.3% *Pravara* | 54% *Madhyama* | 36.7% *Madhyama* | 82% *Pravara* |
| *Rakta* (blood tissue) | 92.6% *Pravara* | 84.7% *Pravara* | 73.6% *Pravara* | 49.5% *Madhyama* | 34.6% *Madhyama* | 82% *Pravara* |
| *Māṃsa* (muscle tissue) | 91.4% *Pravara* | 83.5% *Pravara* | 71.8% *Pravara* | 47.1% *Madhyama* | 33.4% *Madhyama* | 81% *Pravara* |
| *Medas* (fat tissue) | 94% *Pravara* | 81.7% *Pravara* | 68.1% *Pravara* | 39.3% *Madhyama* | 29.2% *Avara* | 76% *Pravara* |
| *Asthi* (bone tissue) | 82.5% *Pravara* | 71.2% *Pravara* | 53.9% *Madhyama* | 21.2% *Avara* | 14.9% *Avara* | 74% *Pravara* |
| *Majjā* (bone marrow) | 83% *Pravara* | 67.4% *Pravara* | 53% *Madhyama* | 18.4% *Avara* | 12.3% *Avara* | 73% *Pravara* |
| *Śukra* (semen/ ovum) | 76% *Pravara* | 66.9% *Pravara* | 52.8% *Madhyama* | 22.4% *Avara* | 13.1% *Avara* | 78% *Pravara* |

| | | | | | | |
|---|---|---|---|---|---|---|
| *Sattva* (mind) | 78.2% *Pravara* | 55.3% *Madhyama* | 39.2% *Madhyama* | 23.3% *Avara* | 12.9% *Avara* | 91% *Pravara* |

According to Table 2, the *Sāra* status of *Rasa*, *Rakta*, *Māṃsa*, *Medas*, *Asthi*, *Majjā* and *Śukradhātu* were at optimal levels in the patients with stage 1 CKD. i.e., they were all in the state of *Pravara sāra*. However, it was observed that the mean percentage score of each *Dhātusārata*in CKD patients with stage 1 decreased from *Rasa dhātu* to *Śukradhātu.*The decrease was shown to be 94% to 76%. The *Sāra*status of *Sattva* of CKD stage 1 patients was at the status of *Pravarasāra*. In patients with stage 2 CKD, the *Sāra*status of *Rasa dhātu to Śukradhātu*was optimal, while the *Sāra*status of *Sattva* was at *Madhyama sāra*. The patients with stage 3 CKD had *Pravarasāra* status only up to *Medas* while the remaining *dhātu*were at *Madhyamasāra* status. There were no patients with *Pravara sāradhātu* in CKD stages 4 and 5. Patients with CKD stages 4 and 5 also had their *Dhātusāra* status changed from *Madhyama* to *Avara sāra*. The peculiarity here is as the disease progressed, *Avara sāra* status could be seen even in the initial*Dhātu*. For example, in CKD stage 3 patients, the *Pravara sāra* status of *Medas dhātu*could be observed, in stage 4 CKD patients *Medas dhātu was in Madhyama sāra* and stage 5 patients it was in *Avara sāra* status. However, in general, it was observed that the mean percentage scores of *Dhātusāratā* decreased from *Rasa dhātu* to *Sattva* at each stage in all cases.

Moreover, it was also observed that the mean percentage score of each *Dhātusāratā* decreased as the disease progressed. For instance, the mean percentage score of *Rasa dhātusāratā* of patients with stage 1 was the highest among the other stages. It was 94% in patients with stage 1 CKD, 85.9% in patients with stage 2 CKD, 75.3% in patients with stage 2 CKD, 54% in patients with stage 4 CKD, and 36.7% in patients with stage 5 CKD.

In healthy controls/ individuals, the mean percentages of all *Dhātusāratā* were at *Pravara sāra* status and the mean percentage score of *Sattva sāra* was the highest among the others. It was 82%.

From an Āyurveda point of view, the previous *Dhātu* is said to feed the next *Dhātu*, according to the *Dhātupoṣaṇa* phenomenon discussed in AṣṭāngaHṛdaSaṃhitāŚārīrasthāna3/62 and CarakaSaṃhitāSūtrasthāna28/3 [21], [9]. i.e., *Rasa dhātu* is responsible for the formation and nourishment of *Rakta dhātu*, *Rakta dhātu* is accountable for the formation and nourishment of *Māṃsadhātu*, and so on. The stage - wise decrease of the *Sāra* mean percentage score from *Rasa* to *Śukradhātu* indicates that the lower *Dhātu* are not nourished well by the upper *Dhātu*. Not only the lower *Dhātu*, but also the mean percentage score of *Rakta dhātusāratā* has decreased, indicating that *Rasa dhātu* is not adequately nourishing it.

Paying close attention to the mean percentage scores of *Sāra* from *Rasa dhātu* to *Śukradhātu* in relation to each stage reveals that the mean percentage score of *Asthidhātu* after *Medas dhātu* is substantially lower than those of other *Dhātu*. That is, from *Rasa dhātu* to *Medas dhātu* and from *Asthidhātu* to *Śukradhātu*, the respective mean percentage scores decreased by very few percentages. However, a considerable decrease could be observed between the *Sāra* mean percentage scores of *Medas* and *Asthidhātu*. As mentioned in Āyurveda literature, *Vṛkka*(kidneys) are closely related to *Medovahāsrotas*(the channels that carry fat tissues) and *Medo dhātu* (fat tissues). *Vṛkka* is considered to be the *Mūla*(root)of *Medovahāsrotas*inSuśrutaSaṃhitāŚārirasthāna9/12 and CarakaSaṃhitāVimānasthāna5/7-8 [10], [9] and according to ŚārangadharaSaṃhitāPūrvakhanda5/45, *Vṛkka* provide nourishment to *Medo dhātu*[22]. Therefore, if *Vṛkka*are damaged, the activities/functions of *Medovahāsrotas* and *Medo dhātu* are constrained, affecting the above the most. Furthermore, *Medo dhātu* would not be adequately nourished. As a result, *Medo dhātu* would not be able to nourish the next *Dhātu* i.e., *Asthidhātu*. This may be a contributing

factor to the considerable decline observed in *Sāra* status in *Asthidhātu*. This finding merits further research studies especially related to the vitiation of *Asthivahāsrotas*(the channels of bones) in CKD patients.Furthermore, when the severity of the disease increases, the *Sāra* status decreases even in the same *dhātu* because, unlike *Deha prakṛti*, the *Sāra* status of a *dhātu* can change with the chronicity of the disease. As the *Sāra* status indicates the *Bala pramāna* (strength) of each *Dhātu*, it can be concluded that the *Bala pramāna* of each *dhātu* starting from *Rasa dhātu* decreases according to the severity of the stages of the disease. Therefore, the above can be generalized and said that the *Bala pramāna* of CKD patients decreases with the progression of the disease.

When the mean percentage score of *Sattva sāra* is considered, it is also evident that the *Sāra*mean percentage score of *Sattva* decreases as the disease progresses. In stage 2, it was observed that the *Sattva sāratā* exhibited a status of *Madhyama sāra*, while the remaining *Dhātu'ssāra* demonstrated percentages at the *Avarasāra* level. It means that the *Sattva*, representing an individual's mind, has a much lower *Sāra* status than the other *Dhātus*of CKD patients. This could be because mental strength deteriorates faster than physical strength when a person is sick.

In terms of CKD patients' mental health, studies have revealed that depression and anxiety are among the most common comorbid illnesses in CKD patients with end-stage renal disease (ESRD) [23], [24], [25].Moreover, it was found thatCKD patients with pre - dialysis have a high prevalence of depression and anxiety, which are associated with lower Quality of Life (QOL), according to the study conducted by Lee et al. (2013) [26] . Cruz et al. (2011) revealed that the quality of life is reduced in CKD patients even in the early stages of the disease, and no association was found between the stages of the disease and the quality of life [27]. According to Ginieri-Coccossis et al. (2008), most quality-of-life domains, including overall mental health, appear to be affected in CKD patients, particularly those who undergo haemodialysis[28]. It can be concluded that such mental disparities may exist among the

patients chosen for the current study, and due to that, they may reduce the status of *Sattva sāratā* of the patients. Collectively, the decrease in quality of life in CKD patients can be correlated with the decrease in *Sāra*status in all *Dhātu*.

Statistically, it was also observed that the mean percentage scores of each *dhātu*and *Sattva* significantly differed according to CKD stages under a 5% significance level (Kruskal Wallis test, *P = 0.000*).Therefore, it is possible to contend that the mean percentage scores of all *Dhātu* and *Sattva sāratā* were significantly associated with CKD stages under a 5% level of significance. Furthermore, significant associations were identified between the mean percentage scores of *Rasa*, *Rakta,Māṃsa*, *Medas, Asthi, Majjā, Śukradhātu* and *Sattva* with all possible pairs of CKD stages such as CKD combined stages 1 and 2 with stage 3, CKD combined stages 1 and 2 with combined stages 4 and 5 as well as CKD stage 3 with combined stages 4 and 5 (Mann – Whitney U test, *P = 0.000*). Moreover, the highest mean percentage scores of the above *Dhātu* were reported in CKD combined stages 1 and 2 and the lowest in CKD combined stages 4 and 5. This implies that in the late stages i.e. stages 4 and 5 of the disease, the *Sārata*levels of the *Dhātu* are also at the lower levels.

### 3.3 Assessment of the association between the status of each *Dhātusāratā* (status of tissue excellence) and*Deha prakṛti* (body constitution) in patients with Chronic Kidney Disease (CKD) - Western Province, Sri Lanka

It was observed that the status of *Rasa, Rakta, Māṃsa, Medas, Asthi, Majjā, Śukradhātusāratā* and *Sattvasāratā*was significantly associated with the *Deha prakṛti* types in CKD patients – Western Province, Sri Lanka, under a 5 % level of significance (Chi – square test, *P = 0.000*) indicating that the *Sāra* status of each *Dhātu* and *Sattva* depends on the types of *Deha prakṛti* in patients with CKD.

If the types of association are further described, among the CKD patients with *Kaphapradhānaprakṛti* types, 100 % had *Pravara sāra rasa*, *Rakta*, *Māṃsa*, *Medas* and *Asthidhātu* while 95.2% had *Pravara sāraMajjā* and *Śukradhātu*. This indicates that a high

proportion of CKD patients with *Kaphapradhānaprakṛti* had *Pravara sāra* status ranging from *Rasa dhātu* to *Śukradhātu*. None of them had *Avara sāradhātu,* while very few proportions (4.8%) had *Madhyama sāramajjā* and *Śukradhātu*.

The study found that a significant proportion (59.6%) of CKD patients with *Pitta pradhānaprakṛti* type exhibited *Madhyama sāra rasa*, *Rakta* and *Māmsadhātu*. Additionally, 27.7% of these patients demonstrated *Pravara sāra rasa*, *Rakta* and *Māmsadhātu*. Nevertheless, it appears that the proportion of individuals exhibiting *Pravara sāra*status for the same *Dhātu*of *Kaphapradhānaprakṛti* is significantly greater than the previously mentioned percentage. Additionally, the *Sāra*status of the initial *dhātu* in the majority of *Pitta pradhānaprakṛti* types has been observed to decrease from *Pravara* to *Madhyama*. However, the percentage of patients with *Pitta pradhānaprakṛti* type with *Pravara sāramedas, Asthi*, *Majjā* and *Śukradhātu* seemed to be decreased compared to those with *Rasa*, *Rakta* and *Māṃsadhātu*. Moreover, the proportion of *Pitta pradhānaprakṛti* CKD patients with *Madhyama sāra* status of *Rasa*, *Rakta* and *Māṃsa* remained stable up to *Māṃsadhātu* and *Madhyama sāra* patient percentage started to decline from *Medas dhātu* while the *Avara sāra* patient percentage for the same started to increase up to *Śukradhātu*. Although none of the patients with *Avara sāradhātu* were reported among *Kaphapradhānaprakṛti* type CKD patients, the patients with *Avara sāradhātu* were reported among *Pitta pradhānaprakṛti* patients from the very first *Dhātu*; *Rasa dhātu*.

The CKD patient count, which represents *Pravara sāra* status from *Rasa* to *Śukradhātu* among *Vātapradhānaprakṛti* types, was significantly deficient compared to those with *Kaphapradhāna* and *Pittapradhānaprakṛti* types. For instance, *Pravara sāra rasa dhātu* was found in 100% of *Kaphapradhānaprakṛti* patients and 27.7% of *Pitta pradhānaprakṛti* patients. However, it could be observed that only 6.8% of *Vātapradhānaprakṛti* patients had *Pravara sāra* status of *Rasa dhātu*. Furthermore, a significant proportion of *Vātapradhānaprakṛti* patients were found to have *Madhyama sāra rasa* and *Rakta*

*dhātu*(63.6% and 61.4% respectively). It was discovered that the majority of *Vātapradhānaprakṛti* types had *Avara sāradhātu* ranging from *Medas* to *Śukra*. In other words, a significant proportion (more than 68.2%) of *Vātapradhānaprakṛti* types comprised *Avara sāra* status of *Medas*, *Asthi*, *Majjā*and *Śukradhātu* while 29.5% - 45.5% of CKD patients with *Vātapradhānaprakṛti* types consisted of *Avarasāra r*asa, *Rakta* and *Māṃsadhātu*.

Collectively, all types of *Dhātu* (from *Rasa dhātu* to *Śukradhātu*) were at *Pravara sāra* status in the majority of CKD patients with *Kaphapradhānaprakṛti* type. It implies that *Kaphapradhānaprakṛti*type CKD patients are more likely to have *Pravara sāradhātu*. A significant proportion of *Pittapradhāna* patients consisted of *Madhyama sāradhātu up to Medas*, whereas a significant proportion of CKD patients with *Vātapradhānaprakṛti* types had *Avara sāradhātu* from *Medas dhātu*.

*Dhātusāraparīkṣa* mentioned in CarakaSaṃhitāVimānasthāna8/102 is performed under the *Rogīparīkṣa* and it provides essential information regarding the *Bala pramāna* (degree of strength or morbidity) of a patient[9]. Moreover, it is believed that if an individual consists of *Pravarasāradhātu*, he /she has maximum *Deha bala* (excellent body strength). Those with *Madhyamasāra* or *Avarasāradhātu*, will have medium or low degree *Deha bala* accordingly. According to the results discussed above, the patients with *Kapha pradhānaprakṛti* type who had *Pravara sāradhātu* can be considered to have the maximum *Deha bala*. Also, according to *Deha prakṛti*literature, CarakaSaṃhitāVimānasthāna8/96 reported that the individuals with *Kaphapradhānaprakṛti*are the strongest among *Vāta* and *Pittapradhāna* types[9]. Therefore, it is possible to say that *Kapha pradhānaprakṛti*patients in the present study may be perfect than the *Pitta* and *Vātapradhānaprakṛti* types in relation to *Deha bala*due to the presence of *Pravarasāra dhātu*. As the majority of *Pitta pradhānaprakṛti* CKD patients have *Madhyama* and *Avarasāradhātu*, it can be assumed that the CKD patients with *Pitta pradhānaprakṛti*have average *Deha bala* and *Vātapradhānaprakṛti*patients have the lowest

*Deha bala* among the three types of *Deha prakṛti*as the majority of *Vātapradhānaprakṛti*patients had a greater amount of *Avarasāradhātu.*

Even though the *Sāra* status of *Sattva* showed a significant association with the type of *Deha prakṛti* of CKD patients, a different distribution pattern could be observed between the two variables compared to that of *Saptadhātusāratā*. The majority (57.1%) of CKD patients with *Kaphapradhānaprakṛti* type had *Madhyama sārasattva,* which is the highest proportion representing *Madhyama sāra* status among them. However, a considerable amount (38.1%) of patients had *Pravara sāra sattva,* followed by 4.8% with *Avara sāra sattva* among*Kaphapradhānaprakṛti* types. This is the only type of*Sāra* that has reached *Avara sāra* status among patients with *Kaphapradhānaprakṛti* and it was the least proportion that consisted of *Avara sārasattva* among *Kaphapradhānaprakṛti* types when compared to the other two types of *Deha prakṛti*. It was also observed that the majority of *Pittapradhāna* and *Vātapradhāna* CKD patients consisted of *Avara sāra sattva* (76.6% and 95.5%, respectively) while none of the patients had *Pravara sāra sattva* among them. In the *Vātapradhānaprakṛti* type, the patient count representing the status of *Avarasāra* was significantly high for those with *Madhyama* and *Pravara sāra* patient counts. As observed in *Saptadhātu*, the majority of *Avara sāra sattva* were detected in the patients with *Vātapradhānaprakṛti* types.

*Sattva sāra* is based on the predominance of psychic factors in the body. *Sattva* denotes the mind according to Āyurveda[9]. It represents the mental status of an individual. The current study revealed that the mental status of CKD patients was very low, even in the patients with *Kaphapradhānaprakṛti* type. As discussed above, *Kaphapradhānaprakṛti* types must have a very high mental threshold because they are generally regarded as the strongest or ideal of the three types of *Deha prakṛti*. But it is clear that it is not so when it comes to the status of *Sattva sāratā*. This demonstrates how much distress they experience as a direct consequence of CKD. Depression and psychological distress were found to be common among CKD patients in Sri Lanka[29]. Another study by the same author found that symptom burden had a substantial impact on both physical and mental health status in CKD

patients[30], whereas Onishi et al. (2019) observed that the mental health impairment of CKD patients is linked with disease progression[31].Therefore, it is clear that the above results are compatible with previous literature.

Regarding the associations between the types of *Deha prakṛti* and *Sāra*status of each *Dhātu* in healthy controls/ individuals, significant associations could be observed in *Dhātus*; *Māṃsa*, *Medas*, *Asthi*, *Majjā*and *Śukra*(*P = 0.02* for *Māṃsadhātusāratā*, *P = 0.000* for *Medas*, *Asthi*and *Majjādhātusāratā, P = 0.002* for *Śukradhātusāratā*) whereas no association could be observed between the types of *Deha prakṛti*and *Rasa dhātusāratā*status*.*This implies that the *Sāra*status of *Rasa dhātu* was not varied or changed according to the type of *Deha prakṛti* in healthy controls/ individuals. In other words, *Sāra* status of *Rasa dhātu* was not dependent on the types of *Deha prakṛti* in healthy controls/ individuals.

*Rakta dhātu* and *Sattva* in healthy controls/ individuals were at their optimal level or the status of *Pravara sāra* regardless of the types of *Deha prakṛti*. 100% of healthy individuals in each *Prakṛti* type (*Vātapradhāna*, *Pitta pradhāna* and *Kaphapradhāna* types) had *Pravara sāraraktadhātu* and *Sattva*.

This indicates that the majority (more than 92%) of healthy controls/ individuals with *Kaphapradhānaprakṛti* consisted of *Pravara sārarakta*, *Māṃsa, Medas*, *Asthi*, *Majjā*, *Śukradhātu* and *Sattva*.

Among *Vāta* or *Pitta pradhānaprakṛti* types in healthy controls/ individuals, a considerable proportion (more than 61.3%) had *Pravara sāraMāṃsa, Medas, Majjā and Śukradhātu*, whereas the majority (58.1%) represented with *Madhyama sāraasthidhātu*.

Further, when comparing the results in CKD patients with healthy controls/ individuals, none of the healthy individuals' *dhātu* was at the *Avara sāra* status, even among the *Vātapradhānaprakṛti* types. However, it was reported that there were a considerable number of CKD patients with *Avara sāra* status related to each *Dhātu* among *Vāta* and *Pitta pradhānaprakṛti* types. The count of *Vātapradhānaprakṛti* CKD patients with *Avara sāra*

status ranging from *Rasa dhātu* to *Sattva i*s significantly higher than that of *Pitta pradhānaprakṛti*types. It rose from 29.5% – 95.5% for *Vātapradhānaprakṛti* patients and 12.8% – 76.6% for *Pittapradhānaprakṛti* patients. It was observed that ranging from *Rasa dhātu* to *Śukradhātu*, all the participants with *Kaphapradhānaprakṛti* types represented the group of CKD patients and the group of healthy controls/ individuals had *Pravara sāra* status. Regarding the *Sāra*status of *Sattva*, the majority (57.1%) of *Kaphapradhānaprakṛti* CKD patients had *Madhyama sāra sattva*, whereas the majority (95.5%) of *Vātapradhānaprakṛti* types had *Avara sāra sattva*. However, it was reported that 100% of healthy individuals consisted of *Pravara sāra sattva* regardless of *Deha prakṛti* type. This is an example of the mental status of healthy individuals being at their best. It was found that depressive disorders are 1.5 – 4 times more common in patients than in the general population[32].

Collectively, it can be said that the *Sāra* status of some *Dhātu,* such as *Rasa*, *Rakta* and *Sattva,* does not depend on the type of *Deha prakṛti* of a healthy controls/ individual and when it applies to CKD patients, the *Sāra* status of all *Dhātu* and *Sattva* depend on the type of *Deha prakṛti* of that particular individual.

**4. CONCLUSION**

In the light of observations and results, it can be concluded that the status ofeach *Dhātu* (from *Rasa dhātu* to *Śukradhātu*) and *Sattva sāra*status are significantly associated with *Deha prakṛti*typesin patients with CKD under a 5% level of significance indicating that *Dhātusāratā*status depends on the type of *Deha prakṛti*in CKD patients. Compared with the results of CKD patients; the *sāra* status of *Medas*, *Asthi*, *Majjā* and *Śukradhātu*are significantly associated with the types of *Deha prakṛti*under a 5% significance level whereas, the *Rakta dhātu*and *Sattva sāratā*of healthy controls/ individuals were at their maximumregardless of the combined types of *Deha prakṛti*. Furthermore, CKD patients with *Kapha pradhānaprakṛti* type can be considered to have the maximum *Deha bala*while those with*Pitta pradhānaprakṛti*have average *Deha bala* and *Vātapradhānaprakṛti* CKD patients

have the lowest *Deha bala*.It was also concluded that the mean percentage score of each *Dhātu*and *Sattvasāra*in CKD patients significantly differedaccording to the disease stages under a 5 % level of significance, indicating that each *Dhātu*and *Sattva sāratā*mean percentage scoreof CKD patients depends on the disease stages and the *Sāra*status of each *Dhātu*including *Sattva* declines from *Pravara sāra* to *Avara sāra* as the disease progresses.

## CONSENT

As per international standards or university standards, written consent from each research participant has been collected and preserved by the author(s).

## ETHICAL APPROVAL

Ethical approval for the study was obtained from the Ethics Review Committee, Faculty of Indigenous Medicine, University of Colombo (ERC/20/103) on 29.01.2021 and by the Research and Ethics Review Committee, University of Kelaniya (UOK/ERC/21/IM/004) on 21.05.2021.

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