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Vegaraju, P., Hankey, A., & Mavathur, R. (2020b). Variations in microbial growth rates explained by traditional knowledge. *International Journal of Yoga - Philosophy Psychology Parapsychology.* 8:33-7. http://www.ijoyppp.org/temp/IntJYoga-PhilosopPsycholParapsychol8133-4991054_135150.pdf

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APPENDICES

APPENDIX-1

1.0 INSTITUTIONAL ETHICAL COMMITTEE APPROVAL

Obtained waiver on 2019.04.13 from Prof. Sanjib Patra, the Secretary, IEC.

From: Department of Yoga and Physical Science
Swami Vivekananda Yoga Anusandhana Samsthana

13th April, 2019

To: The Secretary
Institutional Ethical Committee
Swami Vivekananda Yoga Anusandhana Samsthana
Bengaluru 560105

Dear Sir,

RE: My Research Student Vegaraju Prabhakar

This is to inform you that Mr. Prabhakar's research does not concern humans, but normal growth processes of a variety of E. Coli bacteria, Strain No. K-12 MG 1655, for which we are planning a sequence of 100 or more growth curves for statistical analysis.

We therefore request an official waiver of any requirements for Ethical Clearance from your IEC committee.

Sincerely yours,

A.M.A. Hankey
Alex Hankey M.A. (Cantab.) PhD (M.I.T.)
Distinguished Professor of Yoga and Physical Science
Swami Vivekananda Yoga Anusandhana Samsthana
Prashanti Kutiram Campus
Kalbalu Post, Jigani
Bengaluru District 560105

Cc: Phd Office, S-VYASA

OK
13/04/19

APPENDIX-2

2.0 PUBLICATIONS FROM THIS DOCTORAL THESIS

2.1.1 Influence of Eclipses on Microbiological Growth Rates.

Vegaraju, P., Hankey, A., & Mavathur, R. (2019a). Influence of eclipses on microbiological growth rates. *International Journal of Jyotish Research*.

<http://www.jyotishajournal.com/pdf/2019/vol4issue2/PartA/4-2-6-961.pdf>

2.1.2 Understanding Jyotisha Astrology I: Theoretical Aspects as a Holistic Spiritual Science.

Vegaraju, P., Hankey, A., & Mavathur, R. (2019b). Understanding Jyotisha astrology I: Theoretical aspects as a holistic spiritual science. *International Journal of Jyotish Research*.

<http://www.jyotishajournal.com/pdf/2019/vol4issue2/PartA/4-2-4-966.pdf>

2.1.3 Two New Laws Governing Cell Growth Rate Variances: Small variance for identical start time; and its return to normal. (Accepted for publication).

Vegaraju, P., Hankey, A., & Mavathur, R. (2020a). Two new laws governing cell growth rate variances: Small variance for identical start time; and its return to normal.

2.1.4 Variations in microbial growth rates explained by traditional knowledge.

Vegaraju, P., Hankey, A., & Mavathur, R. (2020b). Variations in microbial growth rates explained by traditional knowledge. *International Journal of Yoga - Philosophy Psychology Parapsychology*. 8:33-7.

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APPENDIX-3

COMPUTATIONAL PROCEDURES FOR SHADBALAS OF GRAHAS

Shadbala way of computing influence of grahas numerically is practical. Assessing various component strengths of grahas in a Kundali helps in the reading of a Jyotisha Kundali.

Graha Shadbalas:

Now, to offer an immediate view of a grahas capabilities about status of a graha, the bhavas graha rules over, the house of its occupancy in a Jyotisha kundali, number of techniques are in vogue. One such useful technique by which an on the spot assessment about a graha's capacity to deliver is by computing the six-fold strengths of a graha, otherwise known as 'Shadbala'. This six-fold value of strength in numerical terms is arrived at for graha at epoch. As per the tradition, if a graha is assigned more numerical value as per the detailed computations being described below, graha is considered stronger. The lesser the value, graha's potency to act diminishes to that extent.

As it is observed how this numerical value is arrived at, not only one can have an idea how grahas can influence matters of interest but also one could opine about such numerical values. Presently, many of the astro computing computer based procedures give Shadbalas for a place and time input. In spite of having minor differences in their algorithms, the computer based computational procedures give out a reasonably good estimate of various constituent parts of graha Shadbalas. Certain options can be made for the computation of graha Shadbalas. Possibly, with an introduction of advanced computational routines, one can choose many an options so as to study the changes dynamically to compare and contrast their possible outcomes. Here in is given only a description of how the traditionally computed Shadbala computing procedures are described. Traditionally this is referred to in Chapter 27 of Brihat Parashara Hora Sastra of sage Parashara.

Table A 3.1: Constituent Components of 6- fold Graha Shadbala	
Details of Six fold Graha Shadbala of 7 grahas	Constituent Components
1. Sthanabala (Strength due to position gained from five components stated opposite)	← Uchhabala ← Saptavargajabala ← Ojayyugmabala ← Kendradibala ← Drekkabala
2. Kaalabala (Strength due to time of day gained from the opposite nine constituent parts)	← Divaratribala ← Pakshabala ← Thribhagabala ← Abdabala ← Masabala ← Varabala ← Horabala ← Ayanabala ← Yuddhabala
3. Digbala (Strength)	← Due to Direction
4. Cheshtabala (Strength)	← Due to Motion
5. Drigbala (strength due from grahas)	← Due to aspects
6. Naisargikabala (Fixed value strength)	← Due to luminosity
Caption: Table A 3.1 depicts component of six-fold graha Shadbalas	

1.0 STHANA BALA

The Sthanabala or strength of a graha due to its position in the zodiac, '*Bhachakra*', is arrived at from five the constituent strengths, balas of Sthanabala. They are *Uchcha Bala*, *Saptavargaja Bala*, *Ojayyugma Bala*, *Kendra Bala*, and *Drekkana Bala*.

1.1 Uchcha Bala:

The first component strength of Sthanabala is "Uchcha" positional strength. In Jyotisha sastra grahas have exact degrees of exaltation or '*uchcha*' position assigned to each one of them. For example, Surya graha is having position of *uchcha*, exalted position, at 10 degrees in *Mesha* rasi. By virtue of being at such an exactly pre-designated position, a graha is assigned numerical points called *Shashtiamsas* and is sixty (60). However, 180 degrees apart from its position of 'exaltation' or '*uchcha*', a graha is in its '*neecha*', or position of its 'debilitation',

and whenever it is in such a place, graha is given 'zero' *Shashtiamsas*, numerical points due to its occupying position of debilitation. In reality, a graha is posited, mostly in between these two, its points of exaltation and debilitation. Accordingly, the *Shashtiamsas* points would be computed by the rule of three. Surya at 10 degrees of *Tula* rasi would be assigned zero *Shashtiamsas* points. And Surya at 10 degrees Karkataka rasi will be assigned 30 *Shashtiamsas* points because *Surya* is posited exactly between 10 degrees *Tula* and 10 degrees *Mesha* Rasis.

1.2 Saptavargaja Bala

By observing the various positions, a graha gets in the divisional or '*Varga*' kundalis, namely *Rasi*, *Hora*, *Drekkana*, *Saptamsa*, *Navamsa*, *Dwadasamsa* and *Trimsamsa*, it is assigned what is known as *Saptavargaja Bala* or strength acquired due to its position in *Varga* kundalis or divisional charts. Whenever a graha is posited in its *Moolatrikona rasi* in the rasi *kundali*, graha gets 45 *Shashtiamsas* points which is a kind of specific rule and is applicable with reference only to rasi chakra or kundali. Whenever graha is posited in its '*swa-rasi*' in any *Varga* kundali, Graha is assigned thirty (30) points of *Shashtiamsas*. If graha is posited in the rasi of its '*adhi mitra*', its great friend and is so assigned 22.5 points of *Shashtiamsas*; and in the rasi of its '*mitra*', a friend's rasi, it would be assigned 15 points of *Shashtiamsas*; and when posited in rasi of neutral graha, graha is given 7.5 *Shashtiamsas* points; and in the rasi of '*Shatru*' or its enemy graha is assigned 3.75 points of *Shashtiamsas*; and finally if graha is posited in the rasi of '*adhi Shatru*', rasi of a great enemy, graha is given 1.875 *Shashtiamsas*. The concept of friends and enemies is well known preliminary in Jyotisha. *Saptavargaja Bala* would assign good number points of *Shashtiamsas*. Hence it is known as one of very important constituents of *Shadbala Bala*.

1.3 Ojayyugma Bala

This component gets added when graha is posited in an even or uneven rasi or D-9 or *Navamsa* kundali. *Sukra* and *Chandra* grahas gain points of 15 *Shashtiamsas* if they are

posited in an even sign. Further, if posited in a Navamsa rasi which is even, these two would be given 15 Shashtiamsas points. Logic behind such a rule could be that being female grahas, Chandra and Sukra would be strong if posited in female (even) signs or Navamsa of even rasi. Surya, Kuja, Guru and Sani, each will be allotted points of 15 Shashtiamsas. If posited in an uneven rasi. Further, these grahas gain another 15 Shashtiamsas points if posited in a Navamsa of an uneven rasi since are male or neutral and would be strong in male (uneven) signs.

1.4 Kendradi Bala

Bhavas are always reckoned with reference to the 1st bhava or Lagna bhava. Any graha posited in a Kendra bhava (1 or 4 or 7 or 10 reckoned from Lagna bhava) would gain 60 points of Shashtiamsas. Similarly, any graha posited in bhavas 2 or 5 or 8 or 11 would be assigned 30 Shashtiamsas points. Further any graha posited in a bhava 3 or 6 or 9 or 12 would gain 15 points of Shashtiamsas. Kendra houses provide for the clearer expression of their roles in Jyotisha and are supposed to be strong.

1.5 Drekkana Bala

Grahas are categorized as masculine and feminine. Surya, Guru and Kuja are considered to be masculine. Sukra and Chandra are known to be feminine. Sani and Budha are considered as neutral grahas. Whenever a male graha is posited in the first drekkana of any rasi (between 0 and 10 degrees) would gain 15 points of Shashtiamsas. Further if a neutral graha is posited in second drekkana of any rasi sign (between 10 and 20 degrees) would be assigned 15 Shashtiamsas points. Lastly, a female graha posited in the third drekkana (between 20 and 30 degrees) of any rasi would gain 15 Shashtiamsas points. In any rasi, placement between 0 and 10 degrees is considered beneficial for male grahas. Similarly, the next portion of 10 degrees would be gainful for neutral grahas. Feminine grahas fare better in the last drekkana of 20 to 30 degrees. To arrive at total Sthanabala value, the values gained by each graha from the constituent five balas would be added up. The criteria applied gives an idea about the influence

of each graha given its numerical value.

2.0 KAALA BALA

Kaalabala is defined as the graha strength gained from its constituent nine balas depending on the temporal or time dimension of reckoning. This constitutes nine individual components strengths namely 1) Divaratri Bala, 2) Paksha Bala, 3) Thribhaga Bala, 4) Abda Bala, 5) Masa Bala, 6) Vara Bala, 7) Hora Bala, 8) Ayana Bala, and 9) Yuddha Bala,

2.1 Divaratri Bala

Chandra, Sani and Kuja are endowed with strength during mid-night. During noon time of the day, these three grahas, the natural malefics and Chandra are powerless. These three grahas are assigned 60 points of Shashtiamsas, if the time of epoch is during night and zero points if it is during noon. The natural benefics and Surya graha, viz., Surya, Guru and Sukra are endowed with strength during noon time of day and are not strong during mid-night time. Thus, Surya, Guru and Sukra gain 60 points of Shashtiamsas if the epoch is during noon and zero points if epoch falls during midnight. Budha graha being of a nature adaptable with whomever associated, is reckoned as strong both during noon and midnight. So, Budha is assigned 60 Shashtiamsas points in any Jyotisha kundali whatever may be epoch time. For the remaining times during day or night, depending on the time of epoch, rule of three is applied to compute the value by interpolation.

2.2 Paksha Bala

A fortnight or Paksha of masa or lunar month is equal to 15 lunar days. Whenever arc-distance between Surya and Chandra is increasing, Chandra is waxing, that Paksha or fortnight is known as Sukla Paksha and starts from new moon or 'Amavasya' Tithi. Whenever arc-distance between Surya and Chandra is decreasing, Chandra is waning, that Paksha or fortnight is known as Krishna Paksha or Bahula Paksha and starts from full moon or Purnima Tithi. The natural benefic grahas Guru, Sukra and beneficial Chandra (when reckoned from

‘Ashtami’ Tithi of Sukla Paksha until ‘Ashtami’ Tithi of Krishna Paksha of a lunar month) and also a benefic Budha associated with one of the above three are endowed with strength during bright half of the lunar month or Sukla Paksha. The malefic grahas Surya, Kuja, Sani and Budha having associated with one of these three and Chandra (reckoned from ‘Ashtami’ of the Krishna Paksha to ‘Ashtami’ of Sukla Paksha) are endowed with strength during dark-half of lunar month. Accordingly, beneficial grahas gain more points of Shashtiamsas if epoch is during bright half of a lunar masa; the malefic grahas gain less during these periods. In a similar tone, malefic grahas gain more points if the epoch is during dark half of lunar month. In all, 60 points of Shashtiamsas would be gained in maximum. So the total points gained by both these groups together will be 60. However, points for Chandra get doubled.

2.3 Thribhaga Bala

As per this rule, the duration of day time, from sun rise to sun set in a place, is divided into three equal parts and similarly, the duration of night time or from sun set to next day’s sun rise at that same place is divided into three equal parts. Guru graha is attributed with 60 points of Shashtiamsas always. Additionally, Budha graha gains 60 Shashtiamsas points if epoch is during first part of day time. Surya graha gains 60 points of Shashtiamsas if epoch is during second part of day time. Further Sani graha gains 60 Shashtiamsas points if epoch is during third part of day time. In a similar fashion, Chandra gains 60 points of Shashtiamsas if epoch falls within first part of the night time. Sukra graha is given 60 points of Shashtiamsas if epoch is within second part of the night time duration. Lastly, Kuja graha is give 60 points of Shashtiamsas if epoch is during last part of the night time duration.

2.4 Abda Bala

The graha bestowed with honour of being ‘Samvatsradhipati’ or simply the lord of the year, as is customary is the lord of the day on which the year begins, will gain 15 points of Shashtiamsas.

There is a possibility for a likely difference here, as it depends on the length of a year in days, either 360 or 365. So it is necessary to follow certain laid out standard traditions and procedures to avoid such mistakes in computations.

2.5 Masa Bala

The graha which is given the honour of being a ‘masadhipati’, lord of the first day of the month in which epoch falls would gain 30 points of Shashtiamsas. Similar problems can surface when calculating Masabala as the case with Abda Bala.

2.6 Vara Bala

The graha who is lord of week day of epoch gains 45 points of Shashtiamsas.

2.7 Hora Bala

Duration of the day, from local time of one sun-rise to the local time of next sun-rise is divided into 24 hours or ‘horas’. Each hora is assigned to be ruled by a graha. The lord of the very first hora is ruled by a graha who rules that day of the week. Further order is followed and maintained. As per the standard order of week days. If epoch happens to be at some distance from the equator the horas will not be of equal length. 12 horas constitute day time duration and another 12 horas constitute night time duration, which obviously varies at any place due to changes in seasons. A cyclical order of grahas is maintained to arrive at the lord of a particular hora of either the day time duration or of night time duration. Taking for example, first hora starts with exact minute of sun rise time at that place. As explained above, each hora duration times are computed and also vary accordingly. If it were Monday, Chandra graha rules first hora; then the order of hora lords to follow will be Sani (2nd), Guru (3rd), Kuja (4th), Surya (5th), Sukra (6th) and Budha hora (7th). Then this order continues to be repeated till next sun rise when exactly the standard order of week days is accomplished. This is also a simple rule of to find week day lord or ‘varadhipati. As per this rule, the graha during whose hora the epoch takes place gains 60 points of Shashtiamsas.

2.8 Ayana Bala

Ayanabala component of Kaalabala depends upon the declination any graha. The declination abbreviated **dec with a symbol δ** , is one of the two angles that locate a point on the celestial sphere in the equatorial co-ordinate system; the other being **'hour angle'**. Declination's angle is measured, north or south of the celestial equator, along the 'hour circle' passing through the point of our interest. If a graha has 0-degree declination, it is assigned a value of 30 points of Shashtiamsas as Ayana Bala. In case of grahas Sukra, Surya, Kuja and Guru, the Northern declinations are added to this value of Ayanabala and the Southern declinations subtracted. As a consequence of this procedure followed, a graha attains low Ayana Bala if the graha has a Southern declination and gains a high value of Ayana Bala if graha has a Northern declination. In respect of Chandra graha and Sani graha, this procedure is reversed and as a consequence it, graha attains low Ayana Bala if Chandra or Sani, graha has a Northern declination and gains a high value of Ayana Bala if graha has a Southern declination. In case of Budha, declinations are always added. In case of Ayanabala, maximum amount of Shashtiamsas points to be gained by any graha is 60. In respect of Surya graha this way Ayana Bala of Surya is always doubled.

2.9 Yuddha Bala

To arrive at a value for this component of Kaalabala of Shadbala, it is to be keenly observed in a Jyotisha Kundali whether two of grahas are at war with each other. This bala is computed for such grahas at war. In case of such an eventuality, a total of Sthanabala +Digbala+ Kaalabala up to its component of Horabala of the two grahas at war is computed individually.

Difference value of these two individual totals computed for each graha is found. Further, this amount of difference in total values thus found is divided by the difference of their individual diameters as observed in the sky. This ratio gives us the component of YuddhaBala. Further

on, this ratio is to be added up to the total Kaalabala thus far computed in case of a winning graha and will be subtracted in respect of losing graha. Simply put, Yuddhabala is gained and gets few more Shashtiamsas in case of a winner and is loss because the graha loses few Shashtiamsas. Total Kaalabala is obtained by adding up all the nine component balas as explained above.

3.0 DIG BALA

Computation of Digbala component of six-fold Shadbalas, is having certain similarities with the procedures applied to compute Uchhabala. Uchhabala of graha is arrived at based on the position of graha in a rasi and its different parts like Navamsa or D-9 divisional kundali. Herein Digbala is computed based on graha position in a bhava (house) reckoned from lagna bhava. Any graha is strong if posited in a certain direction. Digbala (or 'DIK-BALA') means strength obtainable due to the direction. Surya graha and Kuja graha are strong in direction of South. Both of them influence better in tenth bhava which is in the southern part of skies. Sani graha gains maximum Digbala in the West direction and hence does good in seventh bhava. Chandra and Sukra grahas gain their maximum Digbala if posited in North direction which is fourth bhava. In case of Budha and Guru grahas, they maximize their performance in the East which is first lagna bhava.

Any graha gains its maximum Digbala when it is posited in middle of a bhava where performance is considered better. If Chandra is posited in the middle of fourth bhava in a Jyotisha kundali, Chandra gains maximum of Digbala points of 60 Shashtiamsas. In contrast, if Chandra so happens

To be posited in the middle degree of a tenth bhava, Chandra is given zero points of Shashtiamsas for Digbala. In respect of any bhava kundali, middle point of any bhava chart might differ from the middle point of a rasi chart, which happens to be fixed as 15 degrees of rasi. In case of a Bhava Chart, bhava span is not equal in magnitude. Unequal bhava division

is comparable to the Porphyry house system in Western Astrology. Digbala of a graha gives a good indication for how strong a graha is in any bhava.

4.0 CHESHTA BALA

The Surya and Chandra do not acquire any Cheshtabala values because their movement in regular pattern and thence do not enter state of retrogression.

Those grahas which move relatively slow including those under retrogression are assigned a high value of Cheshtabala value. Those grahas which relatively faster are accorded a low Cheshtabala value. It is considered that slow moving grahas are capable enough to focus their energies more because of the considered fact that they move relatively slowly. The maximum amount of Shashtiamsas to be gained by any graha is 60 points of Shashtiamsas. The consideration of the relative speed of a graha is in reality relative to the average speed of a graha. This now makes it a possibility that even in case of Sani graha who is traditionally considered to be moving very slow, 'manda graha'. Comparatively speaking, it is naïve possible that a relatively fast moving Sani graha could be awarded low value of Cheshtabala, in contrast to another relatively slow moving Budha happens to gain a higher value of Cheshtabala.

5.0 DRIK or DRIG BALA

Drik Bala is associated with aspectual strength that a graha receives. Aspects are reckoned from rasi to rasi traditionally. Whenever any graha is aspected by another graha which is benefic the graha being aspected under consideration, gains positive Shashtiamsa values. On the other hand, if any graha is aspected by malefics, this aspected graha is assigned negative Drikbala points of Shashtiamsa. Grahas are considered as either benefics or malefics. The computation of the Drikbala value is an involved procedure because partial aspects have to be considered and are taken into account. Surya, Chandra, Sukra and Budha grahas throw their aspect upon the graha in the **seventh sign** from themselves. These four grahas throw their

aspect upon the zodiacal degree exactly opposite to their positions, 180 degrees from themselves. So applying the rule of three, theoretically speaking, the point in Zodiac which lies at 120 degrees, on either side, from the positions of these grahas receives the so called, partial aspect of 50%; the point in Zodiac which lies away by 90 degrees, on either side, from these grahas receives a partial 75% aspect; those points in zodiac which are away by 60 degrees receive a partial aspect of 25% and those points in zodiac which lie at 30 or 150 degrees from these graha, on either side do not receive any aspect at all. The above explanation applies to Jyotisha whereas rules of aspects differ in western astrology.

In spite of the notion that many a practioners might prefer to work with full 100% aspects being thrown at; for the purposes of computing Shadbala, partial aspects, those aspects which are weaker than full aspects will have to be taken into account also. Mainly being under the influence of malefics, grahas obtain a negative Drigbala value. Similarly, in respect of a positive Drigbala value, the graha is known to be under the influence of benefics. As such this Drigbala value evokes interest. Observing the Drigbala it is known immediately if a graha is mainly under the influence of grahas with a benefic connotation or grahas with malefic connotation and how strong this influence can be to compare with other grahas.

6.0 NAISARGIKA BALA

Luminosity is a measure of brightness of grahas. Seven grahas are ordered by their luminosity. Naisargikabala is the naturally endowed strength of a graha. This constituent part of Shadbala does not depend on any factors that were responsible for the variations in the other five constituents. Naisargikabala is a fixed value of points of Shashtiamsas assigned to each graha as per the feature of their luminosity. Grahas with nearly identical Shadbala values can be evaluated by their Naisargikabala. The graha with a higher value is regarded as relatively stronger. Any graha is attributed with a certain amount of Shashtiamsas as per value of its luminosity. In Jyotisha, Surya is considered to be having maximum brightness. And so, Surya

is assigned 60 points of Shashtiamsas. In contrast, Sani graha is at a distance and is having relatively less luminosity and so is assigned 8.57 points of Shashtiamsas. Other grahas are assigned Naisargikabala as follows. Chandra gains 51.4; Sukra gains 42.9; Guru gains 34.3; Budha gains 25.7; and Kuja gains 17.1, points of Shashtiamsas. This amounts to an observation that the value of Shashtiamsas a graha receives as per its Naisargikabala in any Jyotisha kundali will be the same value.

TOTAL or NET SHADBALA BALA

Total points of Shashtiamsas thus obtained from the six sources of constituent parts of six-fold Shadbala values as explained above make the 'Net or Total' Shadbala of a graha for given place at a specified time. The Shadbala value thus obtained is in Shashtiamsas. Shashtiamsas are also known as units of **Virupas**. As per tradition, 60 units of Virupas or Shashtiamsas make One unit of Rupa of Shadbala. Then if these value in 'Virupas' is divided by 60, Shadbala value in **Rupas** is obtained. Usually Shadbala value is mentioned either in 'Rupas' or 'Virupas'.

It is important to know that the influence of certain Shadbala factors is much greater than others. Simply because the amount of Shashtiamsas to be gained by certain Shadbala factors is much greater than by others. As an example: the amount of Shashtiamsas which can be gained by from constituent source of Sthanabala is a lot more than what can be gained from Digbala. Therefore, some experts opine that the six Shadbala factors are not equally important. However, this is a debatable point because in Jyotisha sastra, many other important and decisive deliberations are available. According to the Shadbala theory of graha bala, every graha needs a certain minimum amount of strength, value in Rupas to be strong enough to deliver. Accordingly, as the minimum of Shadbala strength values, Budha graha needs 7 Rupas, Guru graha needs 6 ½ Rupas, Chandra graha needs 6 Rupas, Sukra graha needs 5 ½ Rupas, and three grahas Sani, Surya and Kuja need 5 Rupas individually. These values, known as the

minimum requirement or a seed value also known as the graha Shadbala “Pinda Values” for a particular graha to be strong enough to act, even though an explanation is difficult to find why it is so.

Table A 3.2: Graha Shadbala Pinda in ‘Rupas’ and ‘Virupas’ for Sapta Grahas							
Graha → “Pinda” value in ↓	Surya	Chandra	Kuja	Budha	Guru	Sukra	Sani
Rupas	6.5	6.0	5.0	7.0	6.5	5.5	5.0
Caption: Shadbala Pinda values, the minimum required for a graha to be “Effective”							

The total Shadbala strength in Rupas is divided by this minimum requirement and then Shadbala strength ratio is obtained. The most important and interesting part of this Shadbala strength ratio is to see whether a graha has more or less than the minimum requirement and by how much that is. The Table A 3.2 above summarizes seven Graha’s Shadbala Pinda, minimum required to be “Effective” and thus categorize graha either to be ‘Effective’ or ‘Less Effective’. We can thus categorize the grahas at a particular place and for a particular time of hour as being “EFFECTIVE”, if the ratio is more than ONE and “LESS EFFECTIVE”, if the ratio is less than ONE. In general, many a scholars attach more importance to the Total or Net Shadbala value only. As it is really difficult from a common understanding of the subject, in finding the logic behind the numbers assigned as minimum requirements and so it has become an usual practice to attach more importance to the total Shadbala. Now, only empirical experiments conducted with the help of Jyotisha parameters, as is done in the present thesis research work, may throw some light on this aspect of deciding this kind of debatable points.

However, in our observations, Grahas possessing Effective Shadbalas, those having obtained net Shadbala value more than their specified Pinda values and the favourable ‘Tithi’, the arc-angular distance between grahas Surya and Chandra appear to influence bacterial

growth behaviour. And grahas Sani and Kuja having higher Shadbalas act mostly “inauspiciously”, including on growth patterns.

Jyotisha is a science and is an art being practiced traditionally over the ages and has its advantages. There is no logical proof for such traditionally practiced techniques. They are being practiced because they give satisfactory results and the long term experience is a proof that they work. Empirically and experimentally they seem correct and are phenomenological.

Some scholars and researchers have come up with other systems to measure the Bala of grahas. These other systems can also be found in Tajika Astrology. In Tajika system of Indian astrology, we find systems which have the same goal that Shadbala has (to measure the Bala or strength of grahas) but have different approach. Also there are authors who have developed slight variations of Shadbala computations. The alternatives are not necessarily better. Most systems that can be an alternative to Shadbala are simpler, therefore easier to calculate, but also have characteristics, which can be criticized. In fact, until this day **Shadbala is the most complete and sophisticated system to measure the Bala (strength) of grahas and therefore highly useful.**

The basic concepts in *Jyotisha* were narrated in Chapter 2.1 to gain the necessary and preliminary information to understand the above computational procedures for Graha Shadbalas. With a long tradition and experience of such notions and techniques of Jyotisha sastra, these phenomenological procedures are to be adopted which seem to be empirically correct.

Table A 4.1: Effective Shadbalas of Sapta grahas at 30 TOFI for GCs on “Eclipse” days

S. No.	GC# Id	Lagna at TOFI	EFFECTIVE Shadbala values of Sapta grahas computed at TOFI							Eclipse Type
			Surya	Chandra	Kuja	Budha	Guru	Sukra	Sani	
1	57	Meena	0.838	1.659	1.007	0.989	1.098	1.421	1.250	P.L.E.
2	58	Mesha	0.868	1.575	1.106	1.046	1.109	1.424	1.161	
3	59	Mesha	0.840	1.574	1.313	1.059	0.956	1.392	1.196	
4	60	Vrishabh	0.904	1.446	0.963	1.143	1.020	1.438	1.296	
5	61	Vrishabh	0.807	1.432	1.163	1.305	1.058	1.255	1.293	
6	68	Meena	1.106	1.496	1.115	1.058	0.924	1.049	1.389	T.S.E.
7	69	Mesha	1.114	1.612	1.215	1.108	0.957	1.118	1.278	
8	70	Vrishabha	1.155	1.569	1.285	1.200	0.845	1.115	1.432	
9	71	Mithuna	1.079	1.421	1.134	1.111	0.963	1.343	1.273	
10	72	Mithuna	1.102	1.394	1.345	1.265	0.988	0.979	1.240	
11	87	Mithuna	0.799	1.072	0.878	0.925	1.077	1.294	1.766	T.L.E.
12	88	Karkataka	0.854	1.157	0.928	0.985	1.309	1.386	1.416	
13	89	Karkataka	0.886	1.314	1.127	0.993	1.156	1.387	1.216	
14	90	Karkataka	1.025	1.315	0.927	0.999	1.156	1.387	1.216	
15	91	Simha	0.894	1.191	1.028	0.899	1.041	1.250	1.266	
16	92	Simha	0.713	1.191	1.058	0.911	1.040	1.432	1.268	
17	93	Kanya	0.727	1.233	0.940	1.100	1.078	1.295	1.369	
18	96	Karkataka	1.107	1.078	1.412	1.334	0.980	1.104	1.334	P.S.E.
19	97	Simha	1.175	1.234	1.224	1.086	0.894	1.194	1.348	
20	98	Simha	1.204	1.032	1.184	1.072	0.924	1.195	1.510	
21	109	Meena	0.762	1.366	1.235	0.836	1.058	1.363	1.557	T.L.E.
22	110	Mesha	0.804	1.284	1.379	0.923	1.101	1.410	1.652	
23	111	Mesha	0.834	1.168	1.339	0.938	1.270	1.446	1.452	
24	112	Vrishabha	0.740	1.042	1.359	0.841	1.023	1.564	1.502	
25	113	Vrishabha	0.915	1.040	1.332	0.851	1.044	1.407	1.502	
26	114	Mithuna	0.826	1.079	1.349	0.900	1.109	1.455	1.602	
27	115	Mithuna	0.852	1.097	1.315	1.056	1.135	1.272	1.569	
28	119	Vrischika	1.232	0.837	1.068	0.910	1.084	0.947	1.737	P.S.E.
29	120	Dhanus	1.077	0.924	1.374	0.927	1.081	0.990	1.837	
30	121	Dhanus	1.188	0.998	1.229	0.907	1.041	0.979	1.880	

Caption: Effective Shadbalas of Sapta grahas at TOFI are shown for Eclipse Days' G.C.

Table A 4.2: Standard Scores of readings of OD 600 nm on “Eclipse” days’ G.C. Experiments

GC#	Eclipse	Standard Scores at time points in minutes from TOFI								Slope
		60	120	150	180	210	240	300	360	
57	P.L.E.	-0.223	0.372	0.844	0.099	1.167	0.500	1.897	1.454	2.160
58		0.943	0.237	-0.415	-0.203	1.069	0.841	1.260	2.114	2.318
59		0.155	-0.615	0.249	-0.148	-0.033	0.096	2.342	0.270	1.906
60		-0.349	-0.234	-0.563	-0.807	-1.394	-0.691	-0.746	0.173	1.744
61		-0.286	-0.436	0.803	0.074	0.356	0.522	2.597	3.318	2.811
68	T.S.E.	-0.349	-0.660	-0.726	-0.499	-0.972	-0.755	-0.332	-0.235	1.625
69		-0.255	-0.525	-1.051	-1.004	-0.778	-1.585	-1.128	-0.487	1.518
70		-0.255	-0.884	-0.997	-1.158	-1.491	-1.798	-1.064	-0.914	1.435
71		-0.223	-0.548	-0.766	-1.016	-0.972	-0.636	-0.364	-0.798	1.468
72		-0.065	-0.480	-0.672	-0.419	-0.810	-0.734	0.114	-0.390	1.601
87	T.L.E.	-0.128	0.416	0.100	-0.191	0.162	-0.202	0.751	-0.041	1.692
88		-0.349	-0.413	0.600	-0.068	-0.616	0.181	-0.395	-0.410	1.513
89		-0.349	-0.839	-0.469	-0.548	0.353	0.011	-0.809	-0.332	1.486
90		-0.349	-0.391	0.194	0.751	0.778	-0.202	0.337	-0.021	1.606
91		-0.349	-0.862	-1.186	-0.985	-1.653	-0.798	-0.395	-0.545	1.574
92		-0.349	-0.862	-0.266	-0.148	-1.361	-1.564	-0.682	0.289	1.780
93		-0.349	-0.862	-1.105	-0.973	-0.259	-1.436	-2.146	-1.070	1.238
96 A	P.S.E.	-0.349	-0.906	-1.010	-1.066	-0.746	-1.010	0.241	0.076	1.779
96 B		-0.349	-0.884	-0.753	-0.597	-0.908	0.564	0.719	0.678	1.949
97 A		-0.349	0.058	-0.320	-0.351	0.227	0.819	0.878	0.425	1.821
97 B		-0.349	-0.189	-0.550	-0.788	-0.810	-0.159	0.114	-0.021	1.712
98 A		0.313	0.237	0.343	0.296	0.616	2.437	1.515	0.483	1.807
98 B		-0.349	-0.436	-0.442	-0.641	-0.551	0.224	-0.204	0.231	1.738
109		T.L.E.	-0.318	1.313	0.316	0.610	1.037	1.245	-0.491	-0.312
110	-0.286		-0.256	0.005	0.000	0.292	0.947	0.464	-0.312	1.548
111	-0.318		-0.592	-0.739	-0.634	-0.486	0.224	0.241	-0.332	1.599
112	-0.191		-0.996	-0.415	-0.271	0.000	0.351	-0.204	-0.351	1.523
113	-0.160		0.551	0.235	0.246	0.972	1.288	0.591	-0.080	1.582
114	-0.349		-0.166	-0.198	-0.505	-0.227	-0.755	-0.268	-0.060	1.651
115	-0.349		2.591	-1.105	-0.739	-1.199	-1.266	-0.714	-0.099	1.668
119	P.S.E.	-0.349	-0.839	-0.523	-0.634	-0.486	-0.032	0.114	0.309	1.789
120		-0.349	-0.480	-0.780	-0.881	-0.778	0.266	0.178	-0.060	1.697
121		-0.191	-0.458	-1.064	-0.597	-1.005	-0.883	-0.491	-0.196	1.632

Caption: Standard Scores of OD 600 nm readings at 8 time points on ECLIPSE DAYS’ G.C.s

APPENDIX - 5

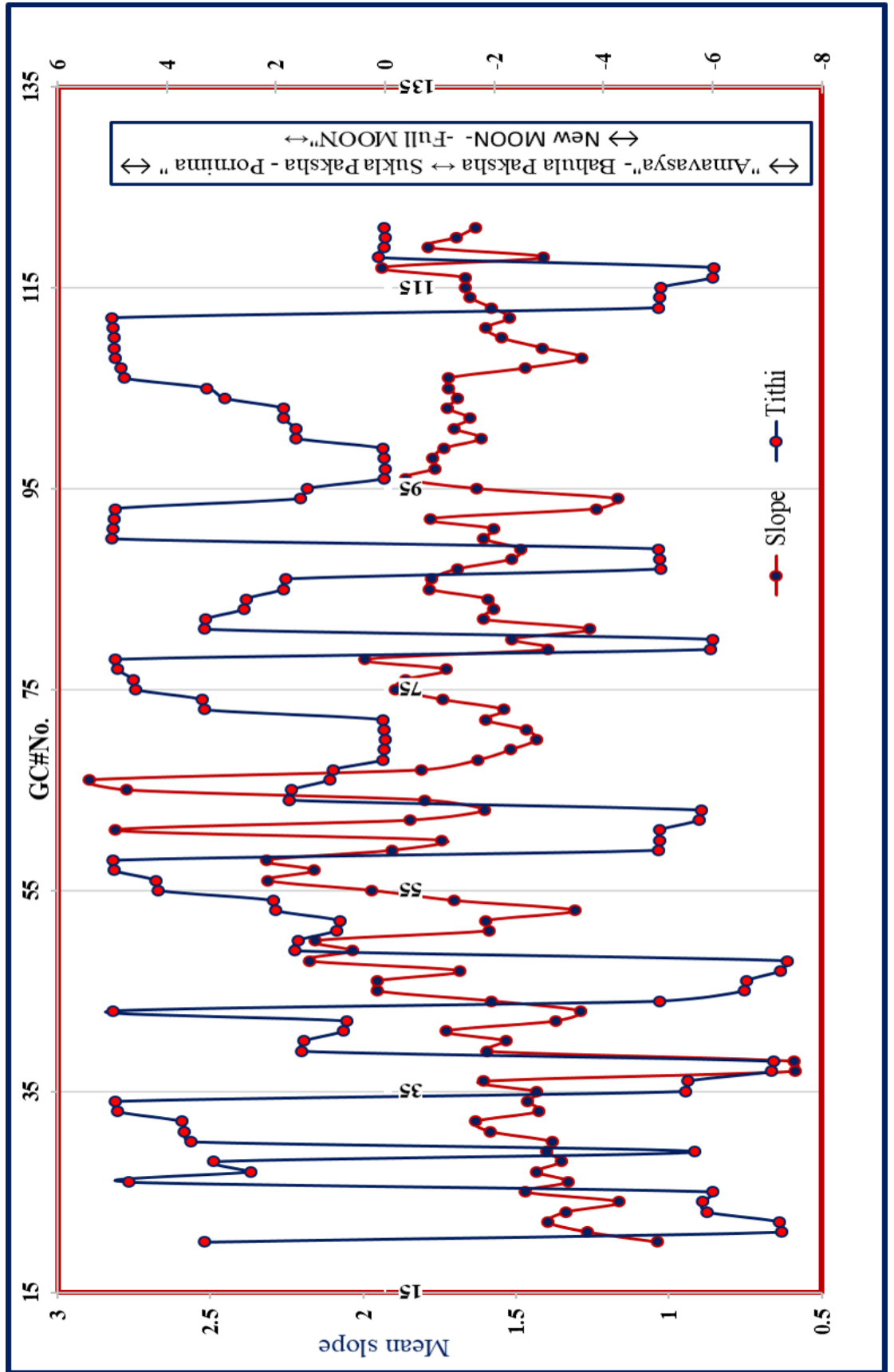
IMPORTANT GRAPHS

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Note: In Graphs A 5.2 through A 5.8.

1. The Primary Horizontal axis gives Growth Curve Number, GC#
2. The Primary Vertical axis gives Effective Shadbala (as bars) of the Graha
3. The Secondary Vertical axis gives Mean Slope of Exp. Phase of G.C (as line).

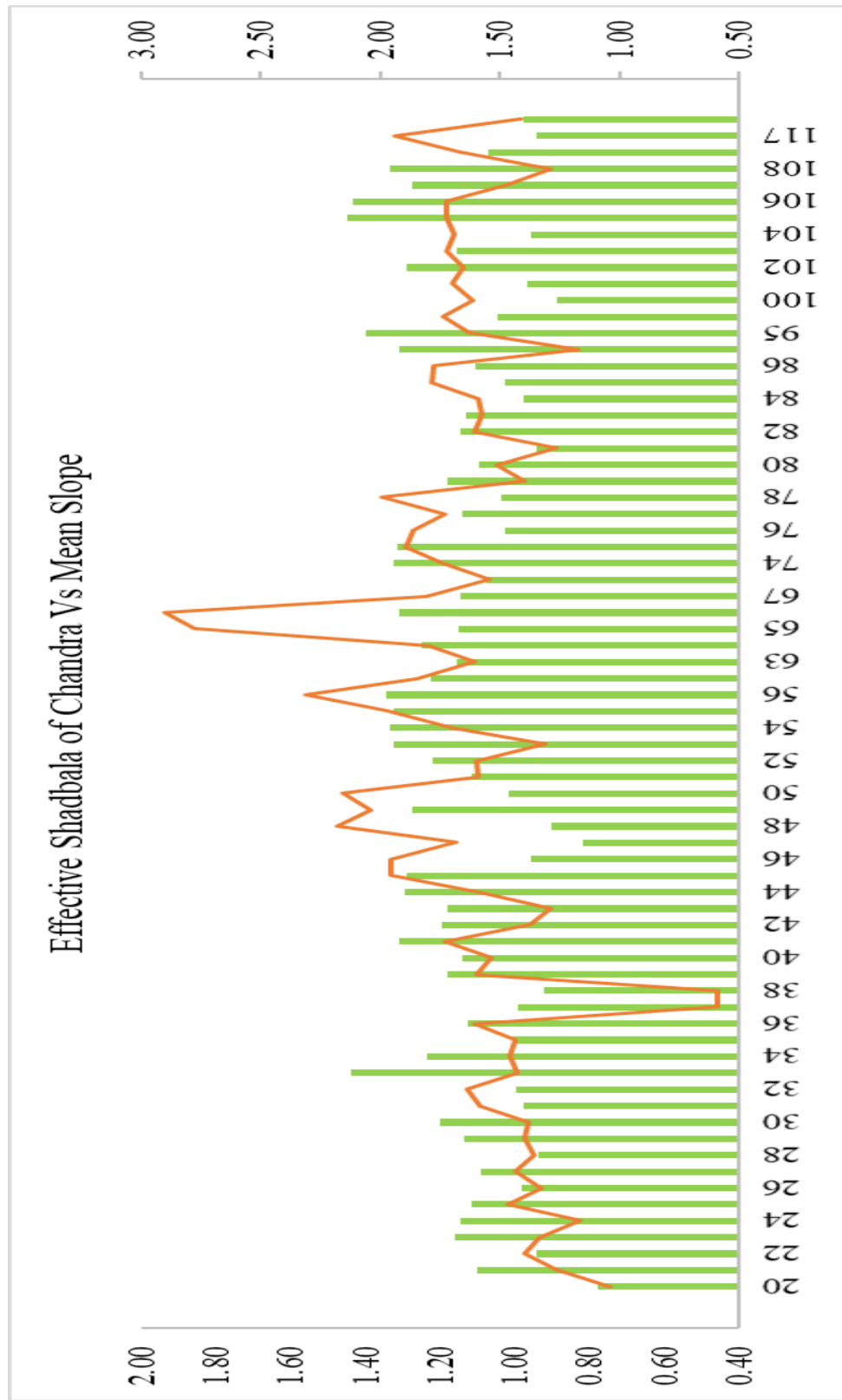
Graph A 5.1



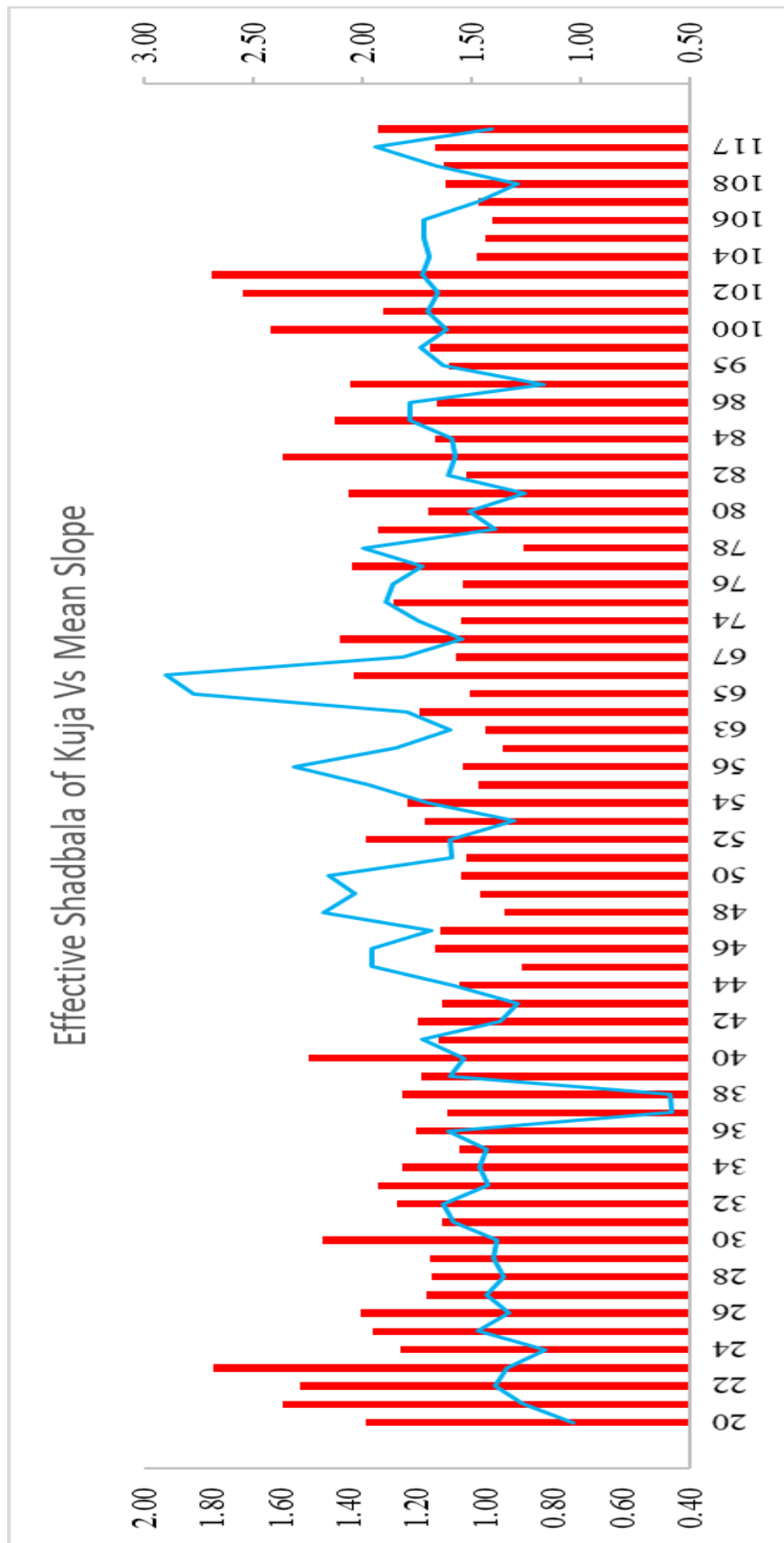
Graph A 5.2



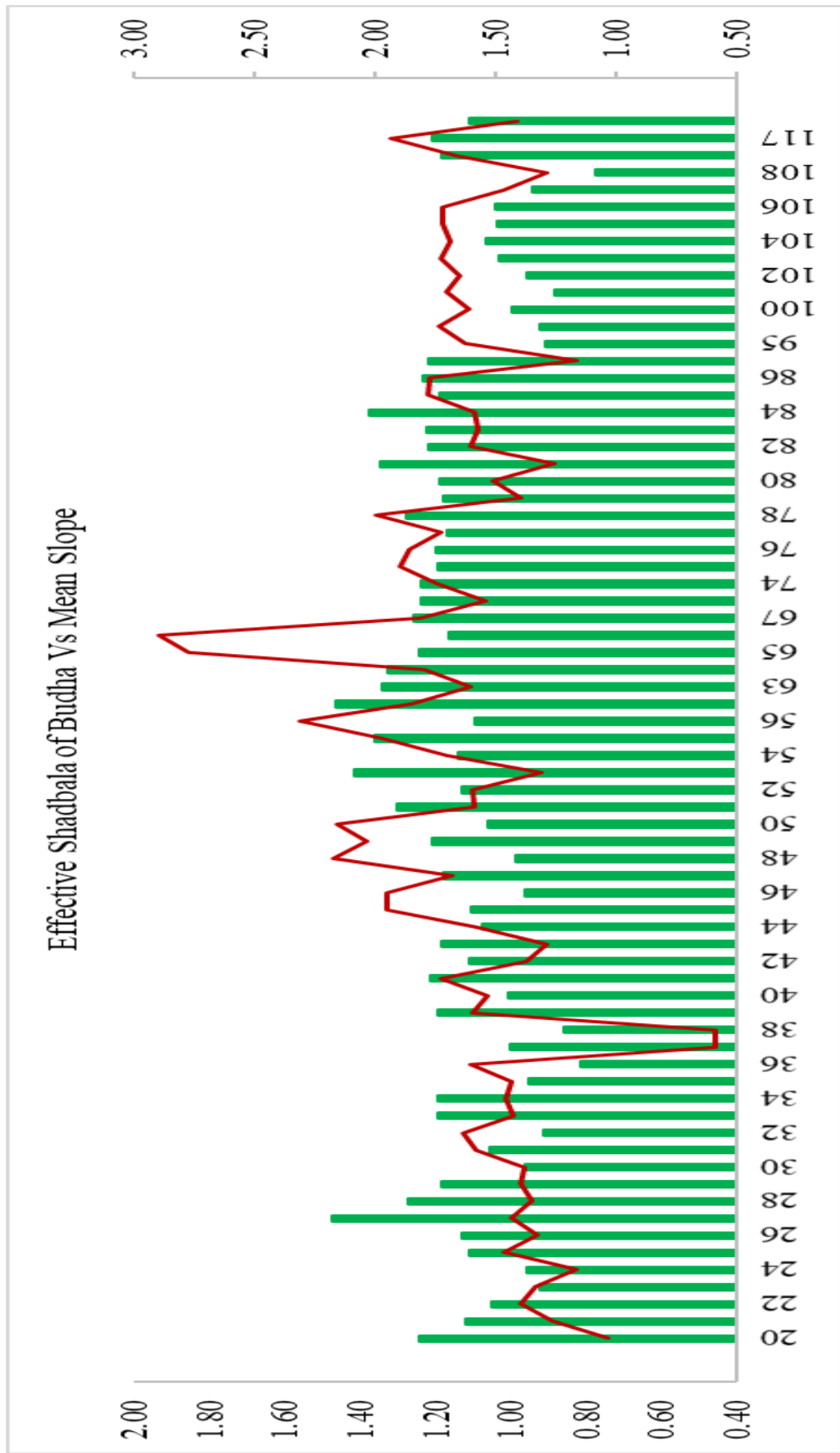
Graph A 5.3



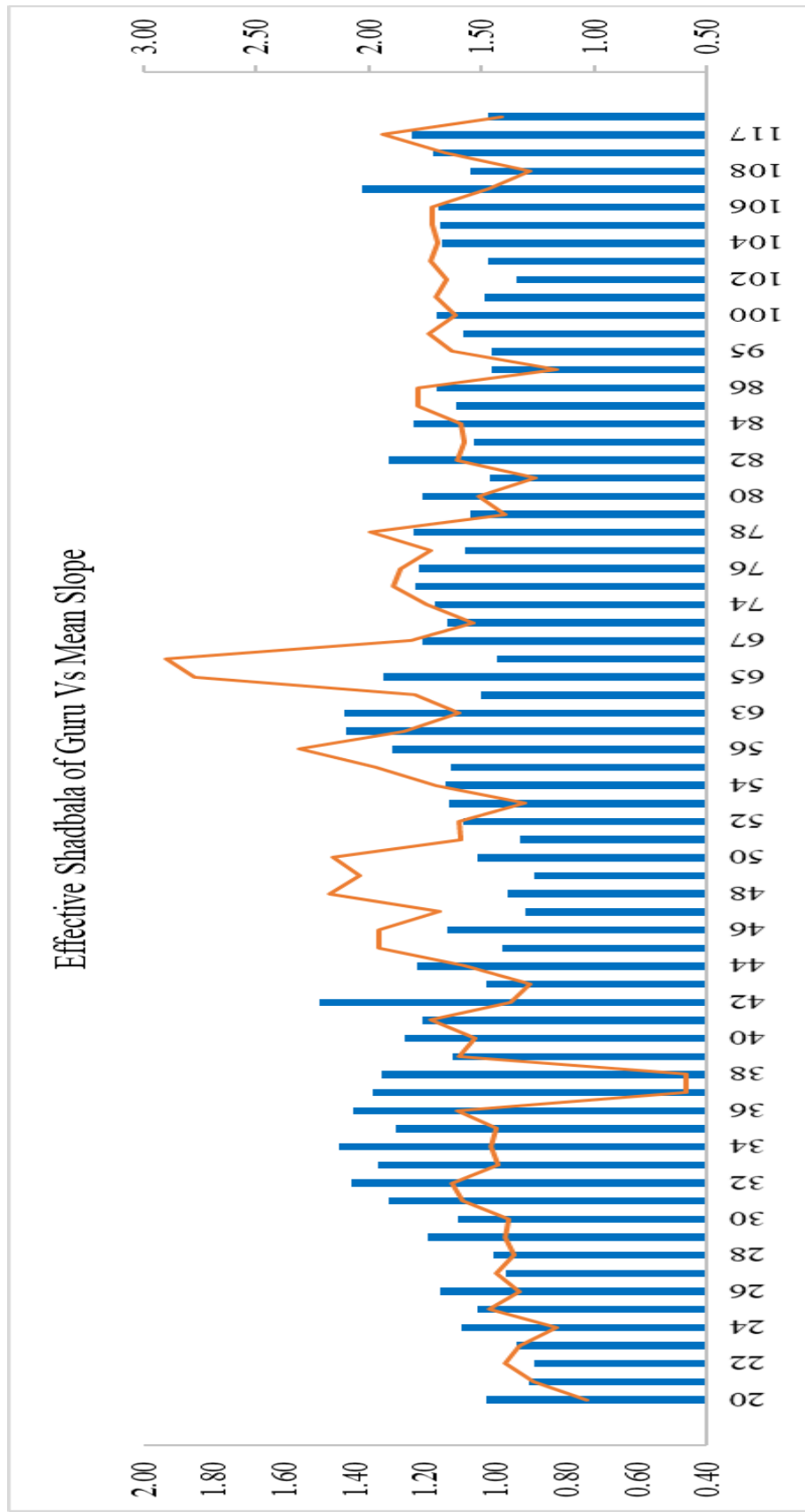
Graph A 5.4



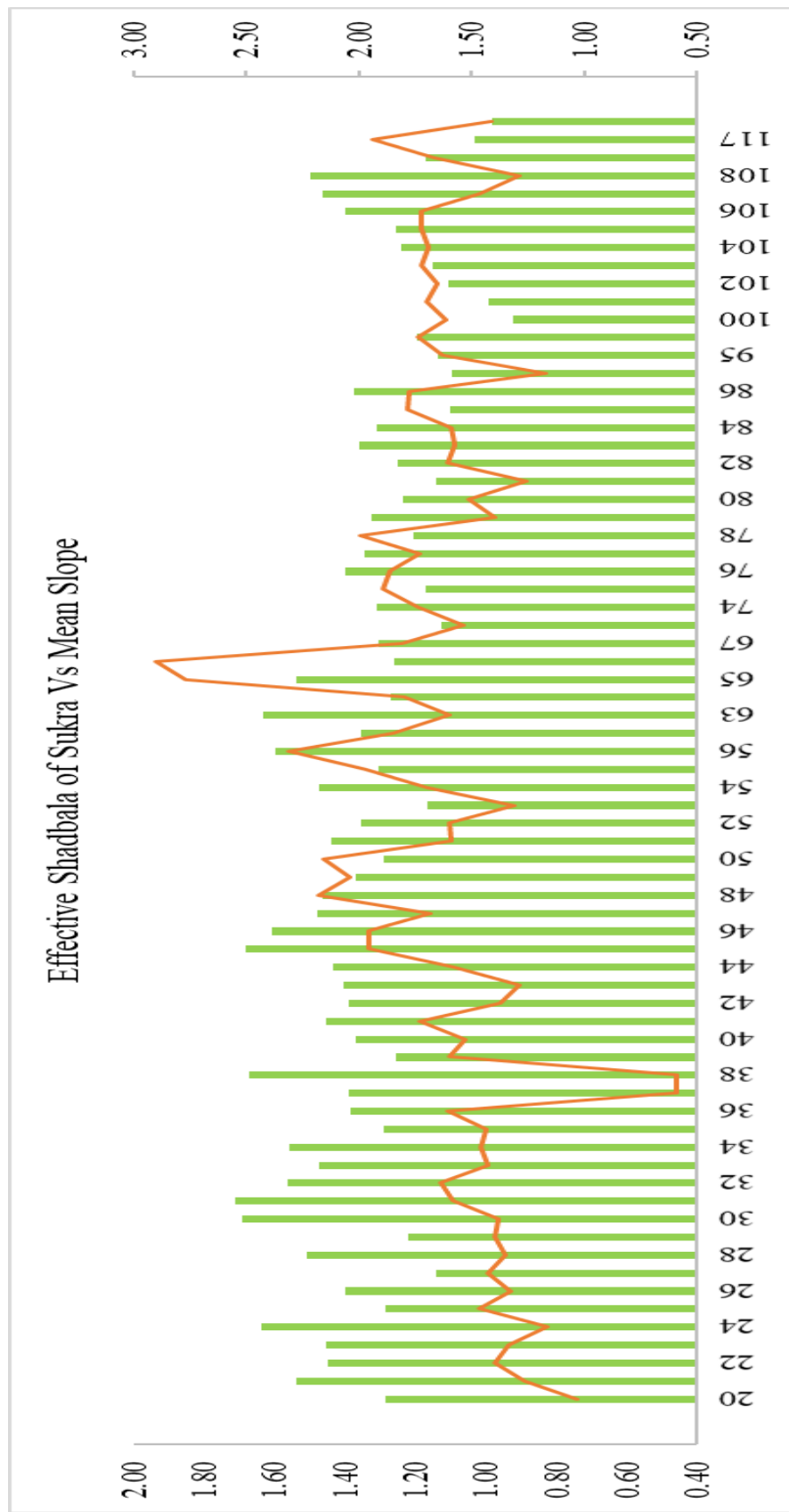
Graph A 5.5



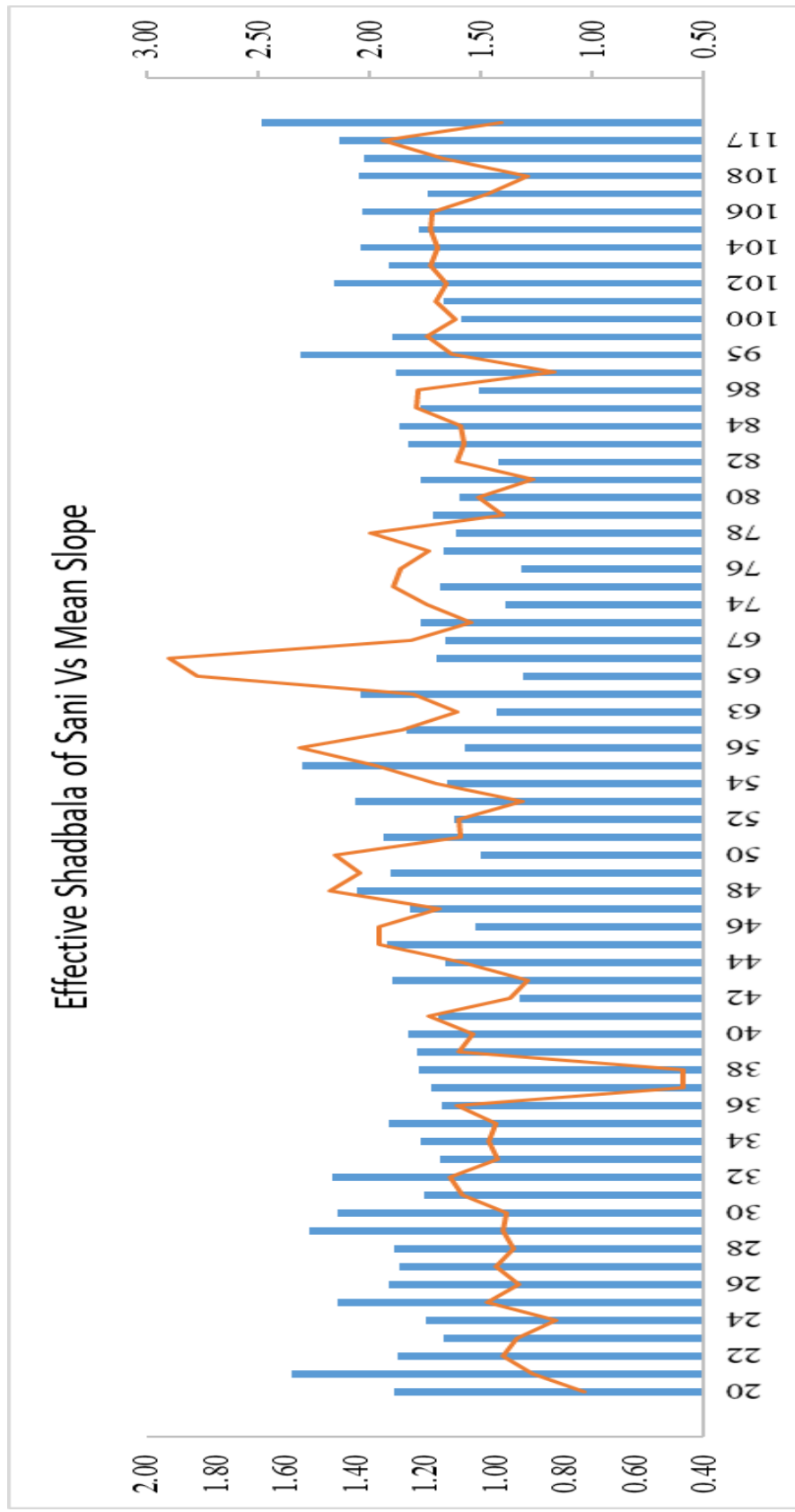
Graph A 5.6



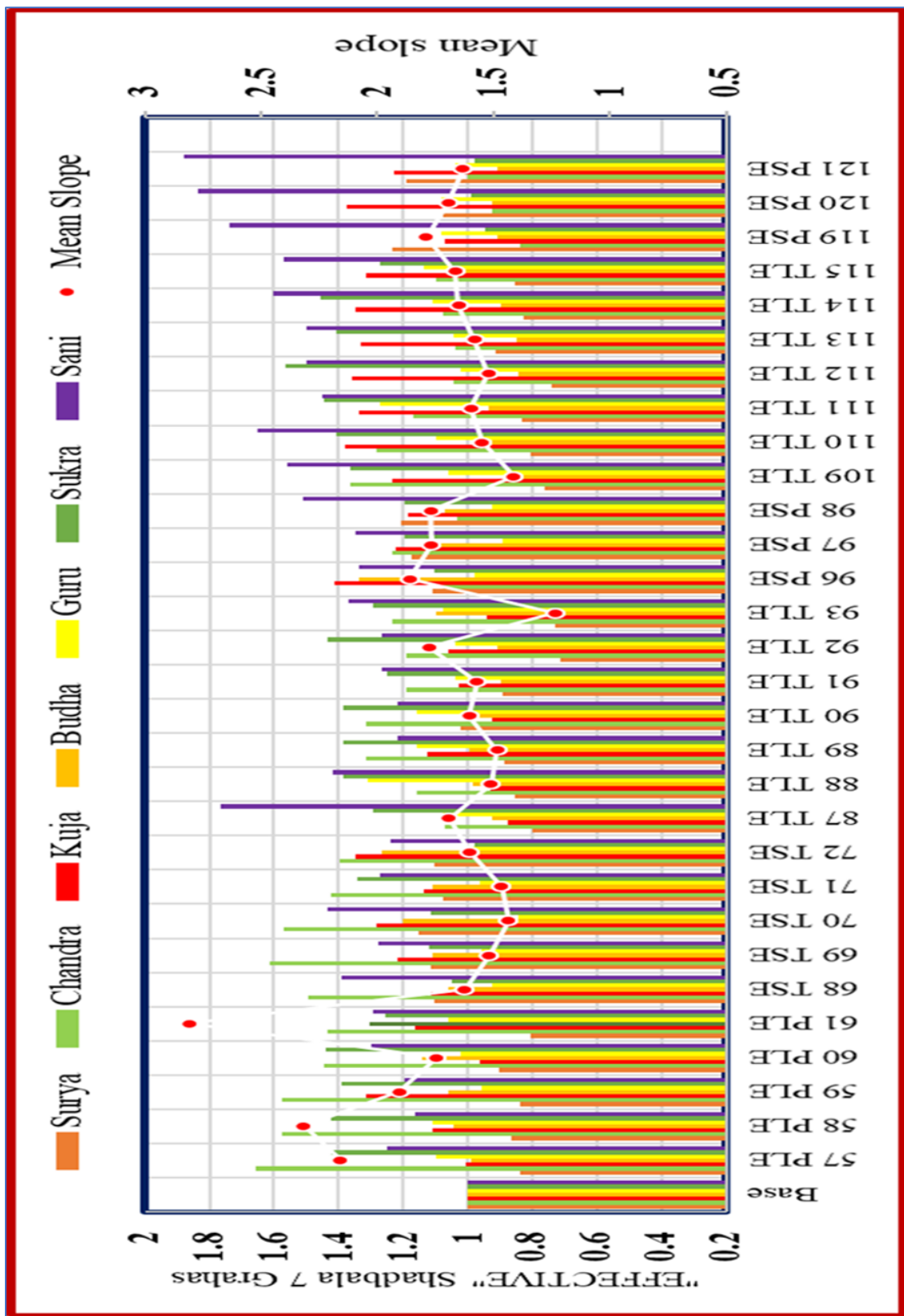
Graph A 5.7



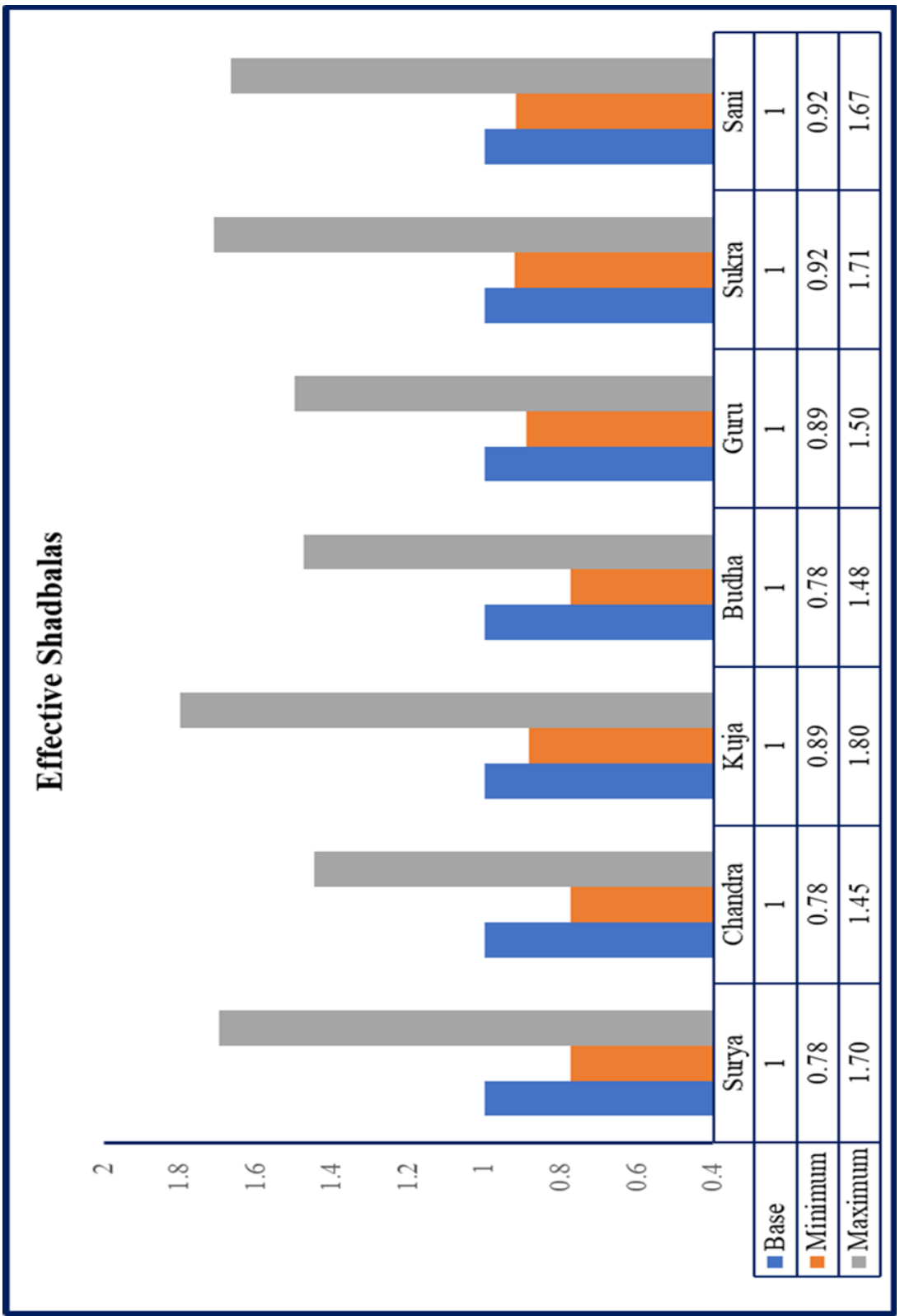
Graph A 5.8



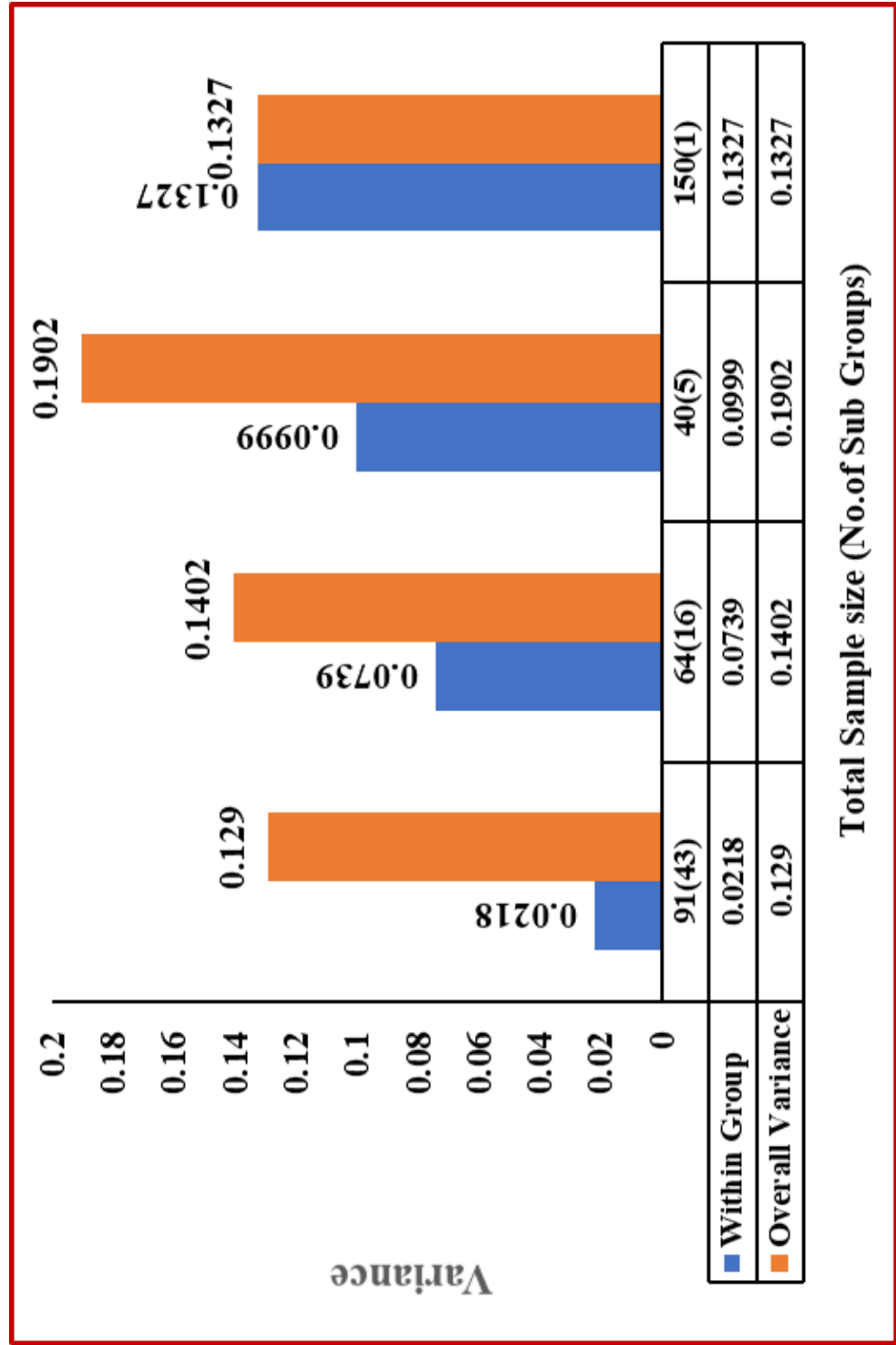
Graph A 5.9



Graph A 5.10



Graph A 5.11



Appendix – 6

Table A 6.0: Descriptive Statistics of Cell Growth Parameters – 150 GCs at 102 TOFIs

150 GCs / 102 TOFIs		Bacterial Population CELL Numbers (Computed from OD 600)				
At Hours from TOFI →		3	3.5	4	5	6
Mean	in Millions	13.25	32.26	61.63	118.87	159.77
Maximum		45.15	73.8	114.9	201	288.6
Minimum		3.63	7.62	22.8	53.4	63
Std.Dev.		5.55	10.06	15.04	21.56	32.35
Variance		3.079E+13	1.01195E+14	2.26325E+14	4.64627E+14	1.04622E+15
150 GCs / 102 TOFIs		Growth Rates (Calculated from OD 600)				
At Hours from TOFI →		3	3.5	4	5	6
Mean		1.66	1.81	1.33	0.67	0.29
Maximum		2.74	2.76	2.79	1.15	0.95
Minimum		0.36	0.76	0.36	0.05	-0.15
Standard Deviation		0.31	0.33	0.41	0.20	0.14
Variance		0.10	0.11	0.17	0.04	0.02
150 GCs / 102 TOFIs		Number of Generations in a Given Time (Calculated from OD 600)				
At Hours from TOFI →		3	3.5	4	5	6
Mean		1.20	1.31	0.96	0.97	0.42
Maximum		1.98	1.99	2.01	1.66	1.38
Minimum		0.26	0.55	0.26	0.08	-0.21
Standard Deviation		0.22	0.24	0.30	0.29	0.20
Variance		0.05	0.06	0.09	0.08	0.04
150 GCs / 102 TOFIs		Number of Generations in one Hour (Calculated from OD 600)				
At Hours from TOFI →		3	3.5	4	5	6
Mean		2.40	2.61	1.91	0.97	0.42
Maximum		3.95	3.98	4.02	1.66	1.38
Minimum		0.53	1.10	0.53	0.08	-0.21
Standard Deviation		0.45	0.48	0.59	0.29	0.20
Variance		0.20	0.23	0.35	0.08	0.04
150 GCs / 102 TOFIs		Doubling Time in Minutes (Method 1)				
At Hours from TOFI →		3	3.5	4	5	6
Mean		26.47	23.96	35.44	71.73	213.30
Maximum		114.05	54.77	114.05	779.11	3611.26
Minimum		15.17	15.09	14.93	36.08	-285.42
Standard Deviation		9.63	5.69	15.29	61.63	350.92
Variance		92.64	32.35	233.71	3797.99	123143.55
150 GCs / 102 TOFIs		Doubling Time in Minutes (Method 2)				
At Hours from TOFI →		3	3.5	4	5	6
Mean		26.64	24.11	35.68	72.21	214.72
Maximum		114.81	55.13	114.81	784.29	3635.25
Minimum		15.27	15.19	15.03	36.32	-287.31
Standard Deviation		9.69	5.73	15.39	62.04	353.25
Variance		93.88	32.78	236.83	3848.64	124785.53