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Kinetic Mean and Kinetic Standard Deviation: New Statistical Concepts with New Research Implications

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Key words: Kinetic mean (Km), Kinetic standard deviation (Ksd), significance, t test, implications

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Abstract: Both Mean (M) and Standard Deviation (SD) are considered basic parameters in statistics and mathematics in measuring central tendencies. Both parameters are widely used in statistical software programs such as Excel spreading sheets, SPSS and others. The main objectives of this study were to introduce new statistical concepts: Kinetic mean (Km) and Kinetic Standard Deviation (KSD) to demonstrate hidden variations and to understand in depth their impact on our understanding of biomedical data. In classic statistics, the M value gives a value for the whole sample and also the SD gives the deviation of all numbers from their M. This study is based on giving the idea of integrating portioned data. The data are further subdivided into short intervals and the M and SD are computed accordingly. Other statistical parameters such as the T test are computed accordingly. At the end of performing many mathematical calculations, a table summarizing the whole parameters is presented. The results of the study showed that the mean of the sample and the kinetic mean were close to each other, although, the kinetic mean was slightly less than that of the sample mean. The standard deviation of the sample was higher than that of the kinetic standard deviation. The main idea of this study was to check the internal variations in both kinetic mean and kinetic standard deviation for each two adjacent figures. In this case, both kinetic mean and standard deviations were shown to be in kinetic mode. We were also able to compute the significance between these values.

INTRODUCTION

The current basic concepts of both mean and standard deviations cannot give full details when the data involve great variations, particularly biomedical data[1]. Accordingly, i am working to develop the kinetic mean and kinetic standard deviation to give values on intervals. I think that this idea will revolutionize our understanding

in many respects. In medicine, nowadays, the concept of personalized medicine has emerged which means individual data have come in focus[2, 3].

In statistics, Mean (M) is the most popular measure for central tendency. Different types of mean have been identified including the arithmetic mean, weighted mean, Geometric Mean (GM) and Harmonic Mean (HM)[4]. The mean can be measured by adding all the values in the data set divided by the number of observations in it. The, mean is given by the formula Mean = sum of all data points/number of data points[5].

The standard deviation is used to measure the amount of variation or dispersion of a set of values. A low standard deviation indicates that the values tend to be close to the mean of the set while a high standard deviation indicates that the values are spread out over a wider range[5].

MATERIALS AND METHODS

To achieve the objectives of the study, a part of the dataset posted in Kaggle[6] was used. A part of the data representing glucose readings was taken for analysis. We extracted the mean and standard deviation of the data and then the kinetic mean and kinetic standard deviations for each two adjacent glucose readings were obtained. Using t test, the significance was extracted.

RESULTS AND DISCUSSION

An example was taken to illustrate the idea of this study. As in Table 1, a part of the data posted on Kaggle representing glucose levels of 60 patients were taken. Descriptive statistics included Mean (M) and Standard Deviation (SD). In this case, M = 94.6667 and SD = 10.58087.

The main idea of this study is to explore the means and standard deviations in a kinetic model. Therefore, the means and standard deviations are computed for each two adjacent readings from the beginning to the last reading (Table 2). The total or the overall mean was 94.6063 and the SD is 8.16966. The overall mean SD was 7.598 and the SD of overall SD was 5.74994. It is worth mentioning that the kinetic mean is close to the total mean while the kinetic SD is relatively less than that of the total or overall SD. The variations in the kinetic mode of both the mean (KM) and SD (KSD) are illustrated in Fig. 1-3.

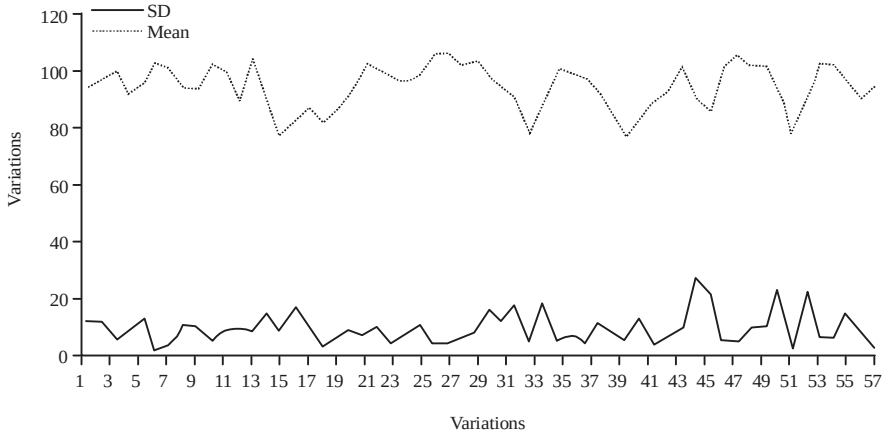

Fig. 1: Kinetic mode of variations of the mean and SD

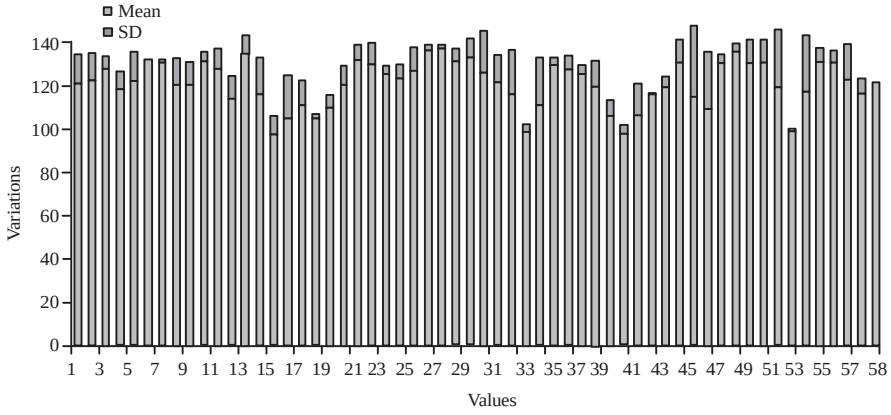

Fig. 2: Histogram representation of Kinetic M and SD

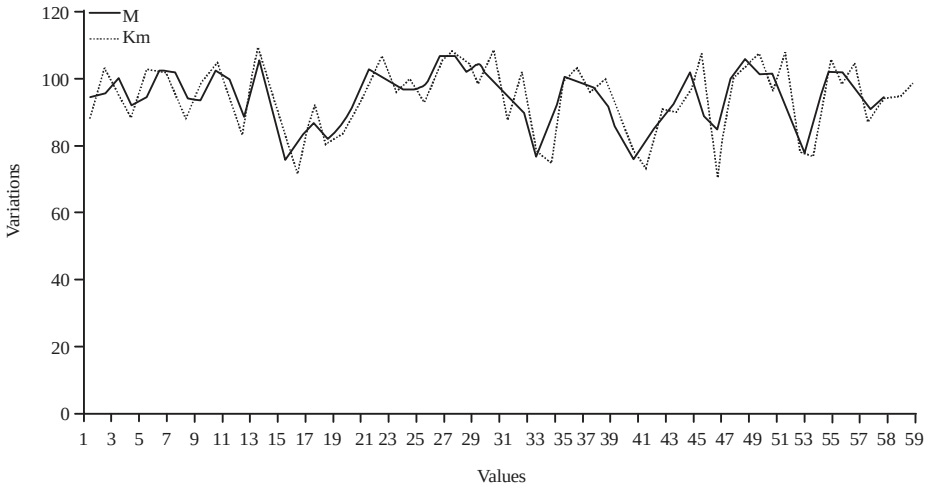

Fig. 3: Representation of Mean (M) and Kinetic mean (Km)

Table 1: Readings of glucose level as posted on Kaggle

Items	Glucose levels	Items	Glucose levels
1	89	32	102
2	103	33	79
3	97	34	75
4	88	35	99
5	103	36	103
6	103	37	96
7	101	38	100
8	88	39	87
9	100	40	79
10	105	41	74
11	95	42	91
12	83	43	90
13	110	44	96
14	100	45	108
15	81	46	71
16	71	47	100
17	93	48	104
18	81	49	108
19	83	50	96
20	89	51	108
21	99	52	78
22	107	53	77
23	96	54	106
24	100	55	99
25	93	56	105
26	105	57	87
27	108	58	95
28	106	59	95
29	99	60	99
30	109	61	M: 94.6667
31	88	62	SD: 10.58087

Table 2: Kinetic model of glucose readings

Factors (glucose)	N	Mean	SD
1	2	96.0000	9.89949
2	2	100.0000	4.24264
3	2	92.5000	6.36396
4	2	95.5000	10.60660
5	2	103.0000	.00000
6	2	102.0000	1.41421
7	2	94.5000	9.19239
8	2	94.0000	8.48528
9	2	102.5000	3.53553
10	2	100.0000	7.07107
11	2	89.0000	8.48528

Table 2: Continue

Factors (glucose)	N	Mean	SD
12	2	105.0000	7.07107
13	2	90.5000	13.43503
14	2	76.0000	7.07107
15	2	82.0000	15.55635
16	2	87.0000	8.48528
17	2	82.0000	1.41421
18	2	86.0000	4.24264
19	2	94.0000	7.07107
20	2	103.0000	5.65685
21	2	101.5000	7.77817
22	2	98.0000	2.82843
23	2	96.5000	4.94975
24	2	99.0000	8.48528
25	2	106.5000	2.12132
26	2	107.0000	1.41421
27	2	102.5000	4.94975
28	2	104.0000	7.07107
29	2	98.5000	14.84924
30	2	95.0000	9.89949
31	2	90.5000	16.26346
32	2	77.0000	2.82843
33	2	87.0000	16.97056
34	2	101.0000	2.82843
35	2	99.5000	4.94975
36	2	98.0000	2.82843
37	2	93.5000	9.19239
38	2	83.0000	5.65685
39	2	76.5000	3.53553
40	2	82.5000	12.02082
41	2	90.5000	.70711
42	2	93.0000	4.24264
43	2	102.0000	8.48528
44	2	89.5000	26.16295
45	2	85.5000	20.50610
46	2	102.0000	2.82843
47	2	106.0000	2.82843
48	2	102.0000	8.48528
49	2	102.0000	8.48528
50	2	93.0000	21.21320
51	2	77.5000	.70711
52	2	91.5000	20.50610
53	2	102.5000	4.94975
54	2	102.0000	4.24264
55	2	96.0000	12.72792
56	2	91.0000	5.65685
57	2	95.0000	.00000
Total	60	94.6667	10.58087
Overall mean	58	94.6063	8.16966
Overall SD	58	7.5980	5.74994

*No significant changes between any two adjacent variables at $p<0.05$

CONCLUSION

This study introduced the new concepts of kinetic mean and kinetic standard deviation as new implications that are expected to impact the understanding of change and the possibility of identifying critical points of disease.

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