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Caffeine and near point plus acceptance

Abstract

The relationship between caffeine consumption and near plus acceptance is investigated. Forty subjects monitored their caffeine consumption for three weeks. The subjects were then categorized according to their average daily caffeine consumption as low, moderate, or high consumers.

Plus lens acceptance was determined by improved performance scores on the Kirschner Visual Performance Test (KVPT) . Each subject took the KVPT six times: twice through their habitual near lens, twice through +0.50 D in addition ~o their habitual near l ens , and twice through +0.75 D in addition to their habitual near lens.

Statistical analysis showed no significant relationship between near plus lens acceptance and caffeine consumption.

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CAFFEINE AND NEAR POINT PLUS ACCEPTANCE

Thesis by
Rick Murray
Tom Ellison

Faculty Advisor
Richard A. Reinke

Submitted to the faculty of
Pacific University College of Optometry

May 1987

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CAFFEINE: The Most Popular Drug in the World

Most of the known caffeine-yielding plants were probably discovered and used in Paleolithic, or Stone Age, times, approximately 600,000 to 700,000 years ago. Paleolithic people probably chewed the seeds, bark and leaves of many plants and they probably associated chewing of parts of caffeine-containing plants with the resulting changes in mood and behavior (Gilbert 1986). Eventually, caffeine was cultivated and consumed to banish fatigue, prolong wakefulness, and elevate mood.

Caffeine is believed to be caused by the action of the drug on adenosine, a body chemical that makes brain cells less sensitive to chemical messages. Caffeine blocks adenosine, a natural tranquilizer, so the brain is overstimulated (Current Health 1985). The toxic effects of excessive amounts of caffeine include insomnia, overexcitement, mild delirium, sensory disturbances such as ringing in the ears and flashes of light, restlessness, and disordered beating of the heart (Enclyclopedia Americana 1987). A period of depression may follow the stimulation that results from the intake of caffeine. (World Book Encyclopedia 1987). Caffeine also raises the body's metabolic rate slightly, increasing the number of calories the body burns. But, it also triggers the release of insulin, causing blood sugar to fall, producing feelings of hunger and letdowns (Goulart 1984).

Nearly all of the approximately 120,000 tons of caffeine consumed in the world each year comes from coffee and tea plants. About 54% of this caffeine comes from coffee beans and 43% comes from tea leaves. The remaining 3% comes from cacao pods which are the basis of cocoa butter, chocolate and white chocolate (Horosko 1985), and also from kola nuts, mate leaves, and many other sources. Only a very small amount is chemically synthesized in laboratories. The caffeine extracted from low-quality coffee beans and tea leaves or that which is collected as a by-product in the decaffeination of coffee and tea is used in soft drinks and medicines.

Why do certain plants contain caffeine?

(1) Caffeine is known to inhibit the actions of bacteria and fungi. This aids the plants in gaining extra protection attack by bacteria, fungi and insects.

(2) Caffeine causes sterility in certain insects, which decreases the insect population.

(3) Because caffeine gets into the surrounding soil, it may inhibit the growth of weeds that might otherwise destroy the plants. Obviously, a plant containing a substance that gives it this kind of protection will have a higher survival rate than one that either has a smaller amount or none at all. However, if caffeine were to harm the plant itself this advantage would be lost. In fact caffeine-containing plants do have mechanisms for protecting themselves against the caffeine's poisonous effects. For example coffee plants produce and store the caffeine in coffee seedlings, away from the sites of cell divisions, which is very sensitive to toxic substances (Raloff 1984).

But, caffeine may still eventually kill the coffee plants that produced it. As a caffeine-bearing bush or tree ages, the soil around it becomes increasingly rich in caffeine that is has absorbed from the accumulation of the plant's fallen leaves, and plantations tend to degenerate after 10 to 25 years.

Pure caffeine is a bitter-tasting white powder that resembles cornstarch. It is moderately soluble in water at body temperature and readily soluble in boiling water.

The duplication of DNA is one of the central processes in the reproduction of cells and whole organisms. Caffeine, because of its similarity to critical parts of the genetic code, can interfere with this process and cause errors in the cells's reproduction. This may result in tumors, cancers, and genetic defects (Lecos 1984).

As stated, caffeine is moderately soluble in water, and therefore, can be found in the body wherever there is water. Caffeine also readily passes through cell membranes. Because of these properties, after caffeine is ingested it is rapidly and completely absorbed from the stomach and intestines into the bloodstream, which distributes it to all organs of the body, including brain, the ovaries, and the testes. In addition when a pregnant woman consumes a caffeine-containing food, the drug goes to all of the organs of the unborn child (Rosenfeld 1986).

Drugs such as caffeine that affect behavior and mood usually do so by acting on some of the 50 billion nerve cells in the brain. To reach the brain the molecules of a drug must first get into the bloodstream, which they do by a process known as absorption. The speed with which caffeine gets from the mouth into the bloodstream depends on a number of factors. Absorption is slower, for example, when the stomach is full or after prolonged fasting. Usually, a single dose of caffeine passes into the bloodstream within 30 minutes of administration (Stephens 1984).

Some drugs reduce the rate of caffeine metabolism. Alcohol has this effect, as does cimetidine, which is used to treat stomach ulcers (Nelson

1986). Use of oral contraceptives can more than triple the half-life of caffeine. Thus, women on the Pill tend to react strongly to a second caffeine dose because of the residual caffeine from earlier dose remains in the blood.

The most important factor contributing to individual variation in acute affects of caffeine is tolerance (Gilliland 1983-84), a condition that occurs with prolonged use of almost all drugs. Tolerance to a particular effect of a drug has occurred when the dose of a drug no longer produces the effect it did initially. Thus, in order to achieve the original effect the dose must be increased.

In humans, studies of caffeine's effects on brain activity have focused on work output (Loke 1984) and athletic performance. The usual finding is that the caffeine in two or three cups of coffee prolongs the amount of time an individual can perform physically exhausting work. The quality of the physical work is not improved, except when the performance only depends on endurance, as in long-distance running, cross-country skiing, and cycling (Cunning 1984). This effect on performance seems greater if the workload is constant rather than increasing. If the work is being done at a high altitude rather than at sea level, and at a normal temperature rather than at a cold temperature. Caffeine has also been shown to shorten the time needed to recover from exhausting work.

Athletes have, in fact, used caffeine to enhance their performance (Dews 1984). Indeed, in 1962 caffeine was classified as a "doping agent" by the International Olympic Committee. It was removed from the list in 1972, but put back in time for the 1984 games (Gilbert 1986).

Caffeine consumption is negatively correlated with good study routines. A study done on 159 students in a psychology class showed a negative correlation on academic grades (Gilliland 1983-84). Where hand hand steadiness or fine motor coordination is required, rather than simple endurance, caffeine can cause a worsening of performance. For example, consumption of two or three cups of coffee has been found to reduce skill at needle threading and handwriting. This is often called the "coffee shakes" (Gilbert 1986).

ABSTRACT

The relationship between caffeine consumption and near plus acceptance is investigated. Forty subjects monitored their caffeine consumption for three weeks. The subjects were then catagorized according to their average daily caffeine consumption as low, moderate, or high consumers.

Plus lens acceptance was determined by improved performance scores on the Kirschner Visual Performance Test (KVPT). Each subject took the KVPT six times: twice through their habitual near lens, twice through +0.50 D in addition to their habitual near lens, and twice through +0.75 D in addition to their habitual near lens.

Statistical analysis showed no significant relationship between near plus lens acceptance and caffeine consumption.

INTRODUCTION

This research project was inspired by earlier work on the effects of caffeine and accommodation pioneered by Dr. A.J. Kirshner. The relationship between caffeine and plus lens acceptance is a relatively new area of study, in fact, the only published research that relates the effects of caffeine on near point plus acceptance was authored by Dr. Kirshner. The article titled "The Effects of Caffeine on Near Point Plus Acceptance" proposes that diet and caffeine, in particuliar, may effect a patient's acceptance of low plus stress relieving lenses. Dr. Kirshner found that patients who consume caffeine are less likely to benefit from low plus near lenses. Dr. Kirshner did not attempt to define the physiological mechanism of this interaction, but rather just established the relationship between caffeine and near plus acceptance. Our research was designed to further test this relationship between caffeine and near point plus acceptance.

DESIGN

To participate in this research project, we required the following:

1. All subjects must have had a visual exam within the past 12 months.
2. Best corrected visual acuity must be 20/20 near and far.
3. Subjects must be binocular near and far.
4. Current habitual near lens must not include a low plus near add in addition to their near refractive error correction, i.e. stress relieving lens.
5. Subjects must not have any systemic or ocular disease.

Forty subjects (mostly Pacific University students) were asked to monitor their caffeine consumption for three weeks, keeping a written log of all products consumed containing caffeine and the amount of the products consumed. An average caffeine consumption value was then calculated for each participant (milligrams of caffeine/day). The subjects were then catagorized according to their average daily caffeine consumption value as low, moderate, or high consumers. Those averaging between 0-50 mg/day were considered low caffeine consumers, those between 51-100 mg/day classified as moderate consumers, and high consuming subjects were those taking in more than 100 mg/day.

Like Dr. Kirshner, we defined near plus lens acceptance as increased performance on the KVPT. (The KVPT is described in detail on page . The KVPT was given October 18th and 19th, 1986, at Pacific University College of Optometry.) Each subject took the KVPT seven times: once to acquaint the subjects with the test, twice using their habitual near lens (if any), twice through their habitual correction plus +0.50 diopters, and twice through their habitual correction plus +0.75 diopters. Trial lens frames were used and the subjects were not told which of the three testing lenses were being used. The two KVPT scores for each lens were averaged for each subject.

Table #1 lists the ages, sex and KVPT averaged scores for each lens used. Tables #2, 3 and 4 are histograms which plot the frequency distribution of the KVPT scores for the habitual lens, +0.50 D lens and +0.75 D lens, respectively. Table #5 is a histogram which plots the frequency distribution of daily caffeine consumption (mg/day).

THE KIRSHNER VISUAL PERFORMANCE TEST

The Kirshner Visual Performance Test (KVPT) is a timed matching test designed to determine if a patient benefits from a potential near point prescription (Rx) by testing near point efficiency. The proposed near point Rx is indicated if the patient's KVPT scores show a decrease in the rate (i.e. time to accomplish task) with the proposed lens relative to their habitual near lens. The proposed near point lens is contraindicated if there is no change in performance or if their is an increase in rate relative to the habitual lens KVPT score.

The KVPT consists of six columns and thirty-five rows of three letter groups. The first three letter group in each row is the stimulus. Using a pencil, the patient scans the remaining five groups of letters in each row, drawing a line through the three letter group of letters matching the stimulus group. The patient then proceeds to the next row and proceeds down the page as quickly as possible for 60 seconds. If the column is completed before the time limit, the score equals the number of seconds taken to complete the task. An additional second is added to the patient's time for each mistake. If the patient is unable to complete the test within sixty seconds, they are stopped and each unanswered question is considered as a mistake. For example, if the patient was unable to complete the last five rows within the alotted sixty seconds and also made one matching mistake, the total score would be sixty-six: sixty seconds for the maximum alotted time, five seconds for each unanswered row, and one second for the matching error.

KIRSHNER VISUAL PERFORMANCE TEST

Instructions

(NUMBERS AND LETTERS)

Place the performance lenses on the patient. (+ lenses or yoked prism made up in strength of +0.50, +0.75, 5 prism base down [esophoria] and 5 base up [exophoria]). Additional lenses can be used according to the judgment of the optometrist.

There are three tests. The first test is used to provide practice and the results noted but not used in the diagnosis. There are six columns. The first one contains the stimulus. Using a pencil, the patient scans the five groups of numbers beside the first stimulus number group, and draws a line through the matching numbers. At the signal "go", the patient proceeds down the page as quickly as possible for 60 seconds. If the column is completed before the time limit, record the number of seconds taken by the task.

Example:

524 543 845 356 742 ~~542~~

The performance lenses are used only in the first two tests and then the third test is taken with the patient's distance Rx or no lenses at all. The performance lenses are prescribed if the third test shows a drop in rate. For example, if the test two showed 35 lines completed and test three gave a score of 31, you have evidence that the lenses increase nearpoint efficiency. If the scores are the same, or if test three shows an increase in rate, then the performance lenses are contraindicated. Visual training is required before a valid nearpoint Rx can be made.

The same testing observations and performance can be obtained with the Letter Test.

Comments:

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KIRSHNER VISUAL PERFORMANCE TEST

CUE ghf - "A"

LETTERS

ghf	wer	kdr	ghf	pti	lhg
dks	dks	ter	mhg	urp	jel
lak	eyu	qop	las	lak	wid
zmx	bdf	utp	zmx	heo	mbe
cnv	lwe	cnv	gty	jel	pyl
bgf	qop	eyc	nem	jtl	bgf
tru	iol	nrk	feo	prl	tru
eow	eow	lke	qoe	czs	gef
rfr	itp	rfr	mng	hyu	der
vgh	yrt	bcd	ncv	vgh	krl
tyu	qwe	bet	tyu	ncv	dfg
rew	hry	oup	fjh	srt	rew
jkf	jkf	wry	ciu	bmg	voi
dls	dls	opu	qor	xiv	nty
cms	wop	dle	fgr	cms	ktl
eos	try	oup	vby	mnr	eos
coe	yer	coe	grt	miy	qli
foo	col	wyr	myu	bet	foo
tie	nry	xot	pil	tie	ber
sle	sle	hty	ale	zve	nmt
fkr	sjt	vnr	fkr	lri	tjy
cke	lep	hit	cke	aur	ber
cow	net	myu	oyp	cow	mrt
spr	jil	spr	aui	wpt	cov
cjr	cjr	uio	zme	hry	fey
vhd	try	ijk	vhd	jkh	mcv
qri	dfe	cgr	qri	jyu	uok
tis	tis	xnr	hou	mto	xmr
qpe	get	qpe	myo	prg	xne
tuf	jek	mne	cbe	tuf	lyj
gke	jeh	gke	vif	xke	uol
tow	flr	kvm	alp	xne	tow
rfv	tyu	agj	cne	rfv	lrp
tgb	ktl	ajt	rty	xnc	tgb
yhn	cne	yhn	mtl	wui	det

1) Start Time ______ Errors ____________________

Start Distance ______ Midway Distance ____

Distance ____________________________________

Ending Time _________________________________

NAME ____

EXAMINER ____________________________________

asd	qas	bvd	ury	uwt	asd
fgh	ywr	xut	fgh	ktr	eio
jkl	qwe	jkl	afw	bxc	mhg
qwe	iop	kel	aer	cxw	qwe
rfv	uep	mfy	dew	rfv	uyl
tyu	zxc	hrl	tyu	gmb	zop
iop	iop	asd	nef	jey	top
lki	oul	lki	bdr	ayr	ujm
juy	wer	afw	uty	qui	juy
hgh	cbv	iyu	hgh	pil	vdf
frf	frf	nxd	ufg	aks	ghj
dew	hry	cib	noi	dew	cot
xcv	rty	dop	sew	ndf	xcv
sfg	yrt	are	ads	xcz	sfg
fds	jek	qop	fds	xbd	myp
ghj	tyu	ghj	ner	asz	xcv
bvc	zpb	mty	try	bvc	oip
dxr	ytu	aop	meo	het	dxr
tmj	tmj	wyu	xov	bed	myu
uio	hel	bet	uio	myu	iol
ksg	lyu	afe	vet	mut	ksg
ssd	met	nvc	iut	ssd	yui
zyj	get	muo	zyj	lip	hrn
dio	dio	srt	mtu	sio	xli
wns	mtu	wns	tui	aje	cut
tid	srt	cvd	ery	tid	bdc
coj	hgb	xds	coj	myu	oer
sow	mro	gjt	efd	sow	mro
cpy	cpy	dke	ltk	ame	nbe
sog	sog	cvd	ktj	ale	thj
wpy	dhe	wpy	mcu	lto	ake
spg	spg	prl	ake	xmt	fkr
dgj	znm	rti	wit	dgj	zmt
slr	uty	slr	ugh	vmr	krg
skg	itu	skg	lyp	wds	znr

2) Start Time ______ Errors ____________________

Start Distance ______ Midway Distance ____

Distance ____________________________________

Ending Time _________________________________

NAME ____

EXAMINER ____________ ____________

tzm	tzm	las	taq	mcs	oud
qpb	plt	awe	yrp	qpb	lfe
rxn	mnd	rxn	ser	ter	ntr
rci	ret	pqi	gey	arw	rci
gru	kel	txz	gru	mcu	sgw
fcm	asf	krl	bem	ryu	fcm
dei	poy	lut	ilj	dei	mbv
swo	swo	ler	wqi	szx	mnb
knc	jrt	knc	qtr	bdc	mnc
hru	dwe	jrh	hru	jro	qol
jvb	xbc	mgj	hkl	bhu	jvb
gti	yui	srt	dfe	znc	gti
awo	awo	fer	nyp	ktl	ger
xsk	mnc	xsk	utp	awe	nmt
cfj	lyi	ats	cfj	yop	ert
vgh	uil	aes	zvr	vgh	lmk
byi	ikj	byi	ade	ptu	ber
neu	yrt	niu	zew	pul	neu
mue	oyl	ads	cxe	mue	jyl
qsx	jyk	uip	age	fgh	qsx
wlm	wlm	yut	zme	ktl	jeo
ejn	rut	iop	ejn	uio	afe
rhb	mne	rhb	yui	qil	zis
tgv	yjc	yui	los	tgv	mrk
yfc	yfc	eop	roy	viu	ntm
urx	bfe	kth	zsa	urx	qad
isz	egr	uhk	cmt	isz	bep
oaz	iop	dke	oaz	eot	yiu
pnj	pnj	ale	nbe	pyl	yth
qbn	ejr	xme	yug	dke	qbn
wcx	rpy	wcx	sir	yjg	vme
enb	enb	aou	qul	cme	byl
rvc	oul	atu	rvc	pjk	brv
tcz	bkt	cle	tcz	jel	xme
tlk	nbr	tlk	alr	xui	egh

3) Start Time ______ Errors ____________________

Start Distance ______ Midway Distance ____

Distance ____________________________________

Ending Time _________________________________

NAME ____

EXAMINER ____________________________________

Hypothesis

Research Hypothesis #1

As a group, the participants will complete the Kirshner Visual Performance Test faster with the +0.50 D than when only wearing their habitual near lens.

Null Hypothesis #1

As a group, the participants will not complete the Kirshner Visual Performance Test faster with the +0.50 D than when only wearing their habitual near lens.

Research Hypothesis #2

As a group, the participants will complete the Kirshner Visual Performance faster with the +0.75 D than when only wearing their habitual near lens.

Null Hypothesis #2

As a group, the participants will not complete the Kirshner Visual Performance faster with the +0.75 D than when only wearing their habitual near lens.

Research Hypothesis #3

Those subjects classified as low caffeine consumers will demonstrate a higher incidence of plus lens acceptance (using the +0.50 D lens) than those subjects classified as moderate or high caffeine consumers.

Null Hypothesis #3

Those subjects classified as low caffeine consumers will not demonstrate a higher incidence of plus lens acceptance (using the +0.50 D lens) than those subjects classified as moderate or high caffeine consumers.

Research Hypothesis #4

Those subjects classified as low caffeine consumers will demonstrate a higher incidence of plus lens acceptance (using the +0.75 D lens) than those subjects classified as moderate or high caffeine consumers.

Null Hypothesis #4

Those subjects classified as low caffeine consumers will not demonstrate a higher incidence of plus lens acceptance (using the +0.75 D lens) than those subjects classified as moderate or high caffeine consumers.

Research Hypothesis #5

Those subjects classified as high caffeine consumers will demonstrate a lower incidence of plus lens acceptance (using the +0.50 D lens) than those subjects classified as low or moderate caffeine consumers.

Null Hypothesis #5

Those subjects classified as high caffeine consumers will not demonstrate a lower incidence of plus lens acceptance (using the +0.50 D lens) than those subjects classified as low or moderate caffeine consumers.

Research Hypothesis #6

Those subjects classified as high caffeine consumers will demonstrate a lower incidence of plus lens acceptance (using the +0.75 D lens) than those subjects classified as low or moderate caffeine consumers.

Null Hypothesis #6

Those subjects classified as high caffeine consumers will not demonstrate a lower incidence of plus lens acceptance (using the +0.75 D lens) than those subjects classified as low or moderate caffeine consumers.

RESULTS

Several statistical methods were used to determine if the low plus lens adds had a positive effect on the group's ability to process information more rapidly. One way analysis of variance (ANOVA) with the F-test was used to make a formal comparison between the variability of KVPT scores using the habitual near lens, +0.50 D lens and +0.75 D lens. (See Table #6.) At the 5% level of significance, the comparison of variances indicated that the KVPT scores were not significantly effected by lens changes. Bivariate statistics showed that when the habitual near lens was plotted against the +0.50 D lens and +0.75 D lens that the least square trend line is nearly .86 and .84, respectively. The correlation coefficients (r) are .84 and .89, respectively. (See Tables #7 and #8). This suggests a strong positive linear relationship between the variables used. A correlation coefficient (r) of 1.0 would indicate a perfect cause and effect relationship. When the habitual lens was plotted against the +0.50 D lens (Table #7), the r value was 0.7177 which suggests that 71.77% of the variation of the +0.50 D lens was accounted for by a linear relationship with the habitual lens.

All statistical analysis indicates that Research Hypothesis #1 and #2 must be rejected; therefore, accepting Null Hypothesis #1 and #2. As a group, the participants did not complete the KVPT faster with either the +0.50 D lens or the +0.75 D lens relative to the habitual lens.

Like the F-test, the T-test is a statistical test of variance.

Paired T-tests results showed no significant change in KVPT performance with lens change. (See Table #9 and #10.)

Twenty-six percent of the subjects, ten subjects, completed the Kirshner Visual Performance Test in an average of two seconds faster using the +0.50 D add as compared to just the habitual near lens. Of these 10 persons, six were low caffeine consumers, two were moderate consumers, and two were high consumers. (See Table #11.)

Research hypothesis #3 proposed a positive statistical correlation between low caffeine consumption and near plus lens acceptance. Forty-nine percent of the subjects, nineteen persons, were classified as low caffeine consumers. Of these nineteen persons, only six persons (thirty-two percent) did benefit from the +0.50 lens and only three persons (sixteen prcent) did benefit from the +0.75 lens.

For seventy-four percent of the subjects, twenty-nine persons, the +0.50 D lens did not have a significant statistical effect or had a deleterious effect. With the +0.75 D lens in place, eighty-seven percent of the subjects, thirty four persons, experienced no significant statistical benefit from the lens or it had a deleterious effect.

Thirty-one percent of the subjects (twelve persons) were classified as high caffeine consumers. Of these twelve subjects, eleven (ninety-two percent) experienced no significant statistical benefit or had a deleterious effect from either the +0.50 D or +0.75 D lens. At first glance this may appear significant; however, fifty-nine percent of the subjects that did not benefit from low plus adds were either low or moderate caffeine consumers.

Bivariate statistics that evaluated the relationship between daily caffeine consumption and the habitual lens, +0.50 D lens and +0.75 D lens (Tables #12, 13 and 14) showed least square trend lines of 3, 4, 6.2 and 7.3, respectively. As the graph shows, these slopes are nearly horizontal, indicating minimal relationships between the variables. Tables #15, 16 and 17 are scatter plots of caffeine consumption (mg/day) vs. the habitual, +0.50 D lens and +0.75 D lens, respectively.

All univariate (see Table #18, 19, 20 and 21) and bivariate statistics indicated that there were no significant statistical differences between those that consume low, moderate or high amounts of caffeine and low plus lens acceptance. Therefore, research hypothesis #3, 4, 5 and 6 were all rejected and Null Hypothesis #3, 4, 5 and 6 were all accepted. There did not prove to be a statistically significant relationship between caffeine consumption and subjects performance on the KVPT.

DATA

Subject	Age	Sex	Habitual 1	+0.50 D over habitual 2	+0.75 D over habitual 3	Caffeine Consumption mg/day
1	22	M	44.00	43.00	45.50	38.00
2	25	M	45.50	45.00	47.50	115.00
3	24	M	31.50	31.00	33.00	6.29
4	24	M	49.50	47.00	49.00	19.00
5	26	F	48.00	44.00	46.50	53.00
6	27	M	48.50	53.00	49.50	371.43
7	26	F	42.50	42.00	43.00	80.00
8	19	F	51.50	54.00	57.00	516.00
9	21	F	50.00	49.00	50.50	78,93
10	33	M	41.50	39.50	43.00	30.86
11	30	F	44.50	43.00	43.50	31.44
12	25	M	46.00	45.50	45.50	0.00
13	28	M	43.00	45.00	43.50	203.29
14	24	F	39.00	40.00	41.00	
15	26	F	57.00	59.50	60.00	186.29
16	26	F	41.50	43.00	43.50	0.00
17	29	F	46.50	45.00	43.00	17.14
18	27	F	43.50	42.00	42.00	133.29
19	24	F	46.50	39.00	40.50	54.28
20	26	M	51.00	52.50	53.00	1,000.00
21	22	M	37.00	35.00	36.50	20.86
22	24	F	55.00	55.00	57.00	99.21
23	39	F	52.00	50.00	50.00	0.00
24	43	F	64.00	58.50	55.00	0.00
25	18	M	62.50	56.00	61.00	2.57
26	21	M	52.00	47.50	48.00	411.14
27	26	F	49.50	48.00	49.00	0.00
28	55	M	38.00	39.00	42.00	171.43
29	52	F	46.00	44.00	46.00	182.14
30	16	F	52.00	52.50	51.00	109.14
31	16	F	40.00	55.00	47.00	42.71
32	17	F	46.50	50.50	51.00	57.14
33	24	M	44.50	47.00	47.50	400.00
34	25	F	53.50	56.00	54.00	0.00
35	19	M	52.00	55.00	54.00	76.00
36	28	F	42.50	41.50	42.50	16.43
37	22	M	50.50	51.50	52.50	28.57
38	25	M	41.50	40.00	41.50	23.00
39	44	F	50.00	50.00	51.00	0.00
40	46	M	48.50	49.00	49.00	57.00

TABLE #1

Histogram

Column (1) Label: lens #1 (habitual)

Group	Low	High	Freq	%Freq	
1	31.50E+00	34.21E+00	1	2.5	:*
2	34.21E+00	36.92E+00	0	0.0	:
3	36.92E+00	39.63E+00	3	7.5	:***
4	39.63E+00	42.33E+00	4	10.0	:****
5	42.33E+00	45.04E+00	7	17.5	:*******
6	45.04E+00	47.75E+00	6	15.0	:******
7	47.75E+00	50.46E+00	7	17.5	:*******
8	50.46E+00	53.17E+00	7	17.5	:*******
9	53.17E+00	55.88E+00	2	5.0	:**
10	55.88E+00	58.58E+00	1	2.5	:*
11	58.58E+00	61.29E+00	0	0.0	:
12	61.29E+00	64.00E+00	2	5.0	:**

TABLE #2

Histogram

Column (2) Label: lens #2 (.50)

Group	Low	High	Freq	%Freq	
1	31.00E+00	33.38E+00	1	2.5	:*
2	33.38E+00	35.75E+00	1	2.5	:*
3	35.75E+00	38.13E+00	0	0.0	:
4	38.13E+00	40.50E+00	5	12.5	:*****
5	40.50E+00	42.88E+00	3	7.5	:***
6	42.88E+00	45.25E+00	8	20.0	:********
7	45.25E+00	47.63E+00	4	10.0	:****
8	47.63E+00	50.00E+00	3	7.5	:***
9	50.00E+00	52.38E+00	4	10.0	:****
10	52.38E+00	54.75E+00	4	10.0	:****
11	54.75E+00	57.13E+00	5	12.5	:*****
12	57.13E+00	59.50E+00	2	5.0	:**

TABLE #3

Histogram

Column (3) Label: lens #3 (.75)

Group	Low	High	Freq	%Freq	
1	33.00E+00	35.33E+00	1	2.5	:*
2	35.33E+00	37.67E+00	1	2.5	:*
3	37.67E+00	40.00E+00	0	0.0	:
4	40.00E+00	42.33E+00	5	12.5	:*****
5	42.33E+00	44.67E+00	7	17.5	:*******
6	44.67E+00	47.00E+00	4	10.0	:****
7	47.00E+00	49.33E+00	7	17.5	:*******
8	49.33E+00	51.67E+00	6	15.0	:******
9	51.67E+00	54.00E+00	2	5.0	:**
10	54.00E+00	56.33E+00	3	7.5	:***
11	56.33E+00	58.67E+00	2	5.0	:**
12	58.67E+00	61.00E+00	2	5.0	:**

TABLE #4

Histogram

Column (4) Label: caffiene consumption (mg/day)

Group	Low	High	Freq	%Freq	
1	0.00E+00	83.33E+00	26	66.7	:*************
2	83.33E+00	16.67E+01	4	10.3	:**
3	16.67E+01	25.00E+01	4	10.3	:**
4	25.00E+01	33.33E+01	0	0.0	:
5	33.33E+01	41.67E+01	3	7.7	:**
6	41.67E+01	50.00E+01	0	0.0	:
7	50.00E+01	58.33E+01	1	2.6	:*
8	58.33E+01	66.67E+01	0	0.0	:
9	66.67E+01	75.00E+01	0	0.0	:
10	75.00E+01	83.33E+01	0	0.0	:
11	83.33E+01	91.67E+01	0	0.0	:
12	91.67E+01	10.00E+02	1	2.6	:*

TABLE #5

Analysis of Variance Report

Dependent Variable 4 caffiene consumption (mg/day)

Source	df	Sums of Squares (Sequential)	Mean Square	F-Ratio	Prob>F
Constant	1	550108.2	550108.2		
Model	3	135798.3	45266.09	1.24	0.310
Error	35	1277427	36497.9		
Total	38	1413225	37190.13		

Root Mean Square Error	191.0442
Mean of Dependent Variable	118.7659
Coefficient of Variation	1.608578
R Squared	0.0961
Adjusted R Squared	0.0186
Durbin - Watson Statistic	2.052095

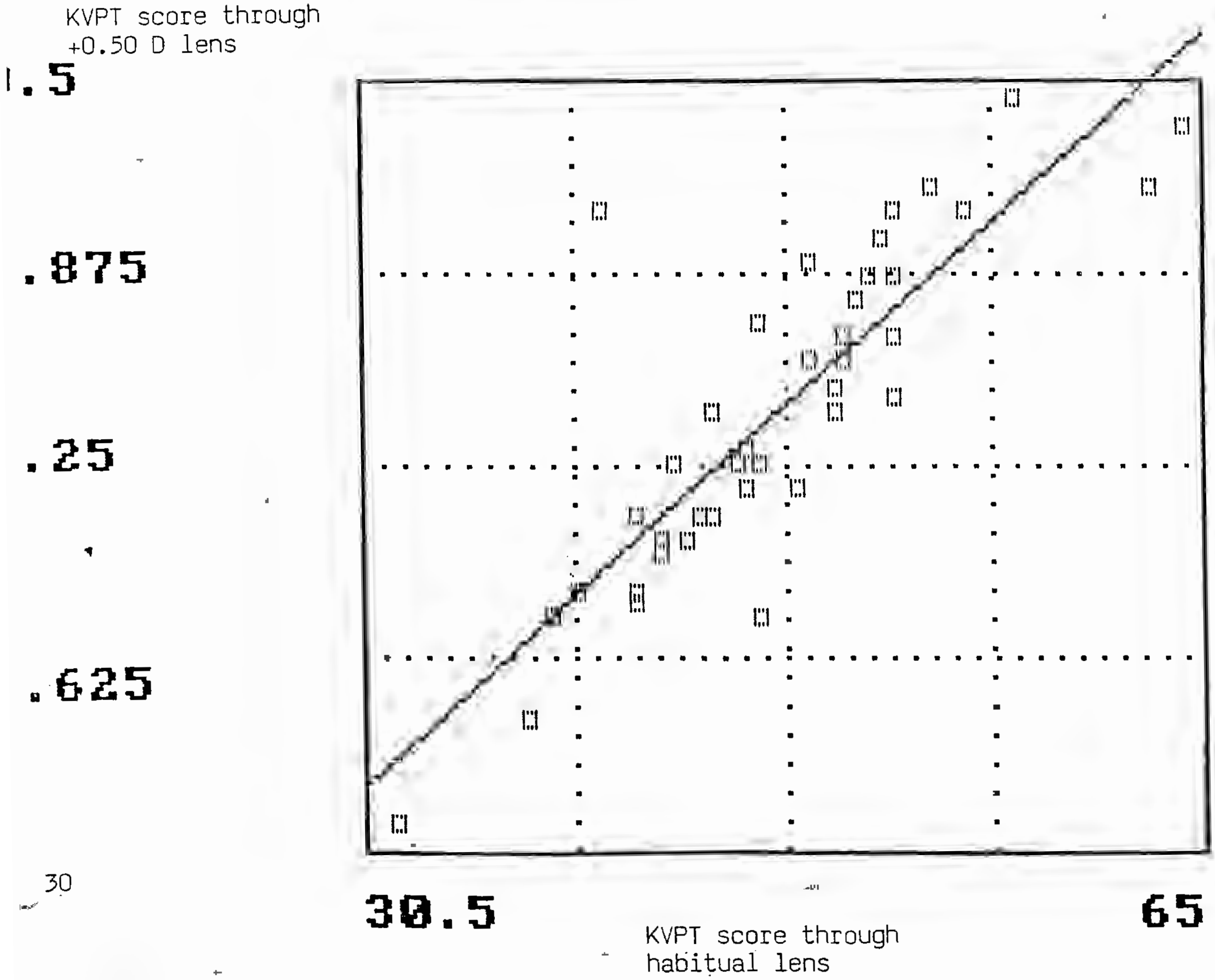
TABLE #6

Bivariate Statistics

Dependent variable is col(2) lens #2 (.50)
Independent variable is col(1) lens #1 (habitual)

Number of rows processed	40
Number of non-missing rows	40
intercept (a)	6.449173
Slope (b)	.8604888
R-Squared	0.7177
Correlation Coefficient (r)	0.8472
Mean Squared Error (MSE)	12.55537
Standard Error of Regression	3.543356
Mean of X(1)	47.2125
Mean of Y(2)	47.075
Regression Sum of Squares	1213.171
Error Sum of Squares	477.1041
Total Sum of Squares	1690.275
T-value for testing b=0	9.829834
Tail probability for T-test	0.000

TABLE #7

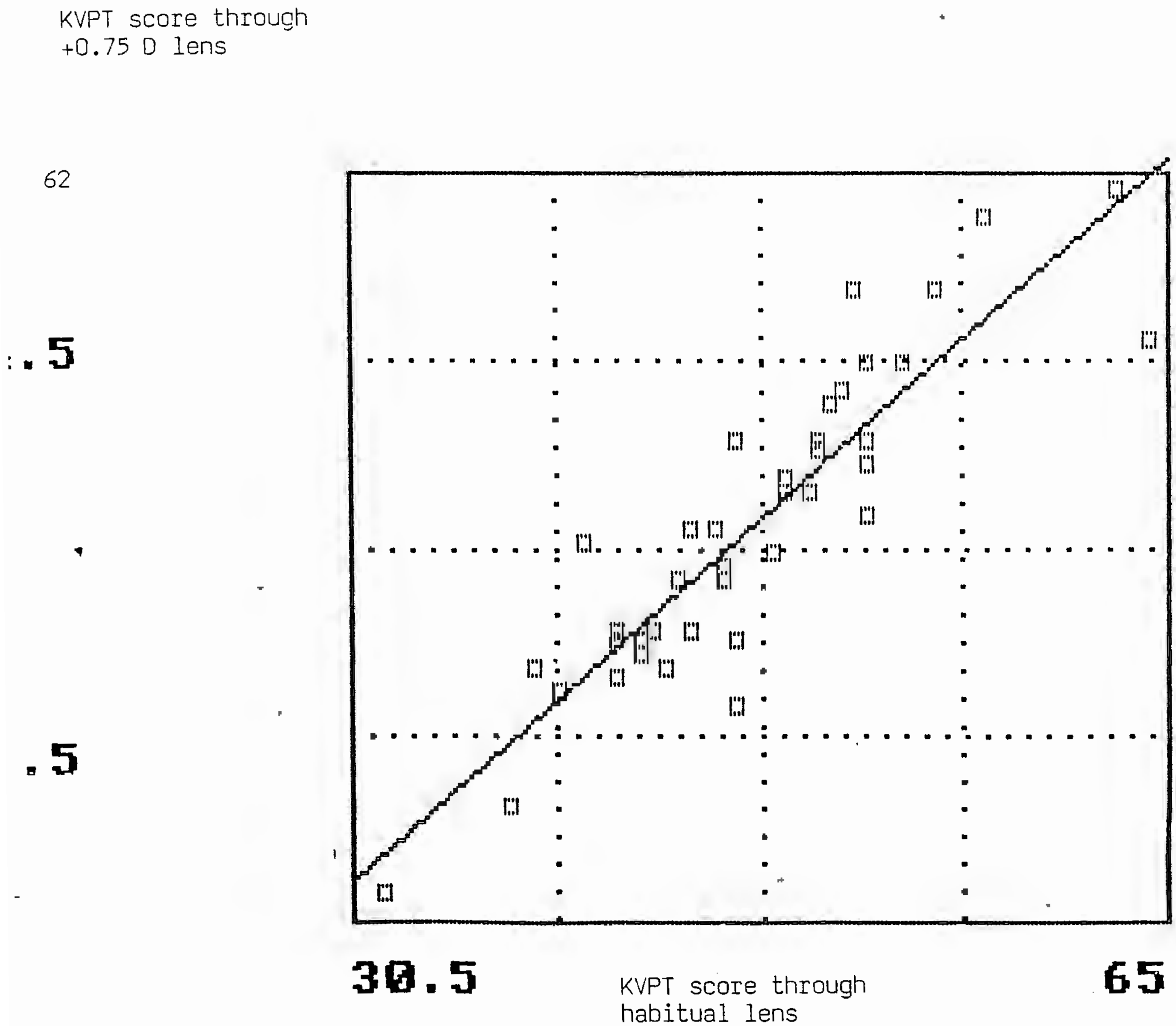


Bivariate Statistics

Dependent variable is col(3)	lens #3 (.75)
Independent variable is col(1)	lens #1 (habitual)

Number of rows processed	40
Number of non-missing rows	40
Intercept (a)	7.92026
Slope (b)	.8412442
R-Squared	0.8044
Correlation Coefficient (r)	0.8969
Mean Squared Error (MSE)	7.420543
Standard Error of Regression	2.724067
Mean of X(1)	47.2125
Mean of Y(3)	47.6375
Regression Sum of Squares	1159.513
Error Sum of Squares	281.9806
Total Sum of Squares	1441.494
T-value for testing b=0	12.50029
Tail probability for T-test	0.000

TABLE #8



Paired T-Test Results

Column 1 has the label: lens #1 (habitual)		
Column 2 has the label: lens #2 (.50)		
Sample size	:	40
Mean of column 1 is	:	47.2125
Mean of column 2 is	:	47.075
Mean difference is	:	.1375
Std. error of difference is	:	.5712075
t statistic	:	.2407181
Right tail probability	:	0.406
Two-tailed probability	:	0.811

TABLE #9

Paired T-Test Results

Column 1 has the label: lens #1 (habitual)		
Column 3 has the label: lens #3 (.75)		
Sample size	:	40
Mean of column 1 is	:	47.2125
Mean of column 3 is	:	47.6375
Mean difference is	:	-.425
Std. error of difference is	:	.4552225
t statistic	:	-.9336094
Right tail probability	:	0.822
Two-tailed probability	:	0.356

TABLE #10

Caffeine Consumption

	0-50 mg/day low	51-100 mg/day moderate	100 mg/day high
A	6	2	2
B	3	1	1

A = Subjects whose speed on the Kirshner Visual Performance Test was $\geq$ 2.0 seconds faster using the habitual plus +0.50 lens relative to just the habitual near lens.

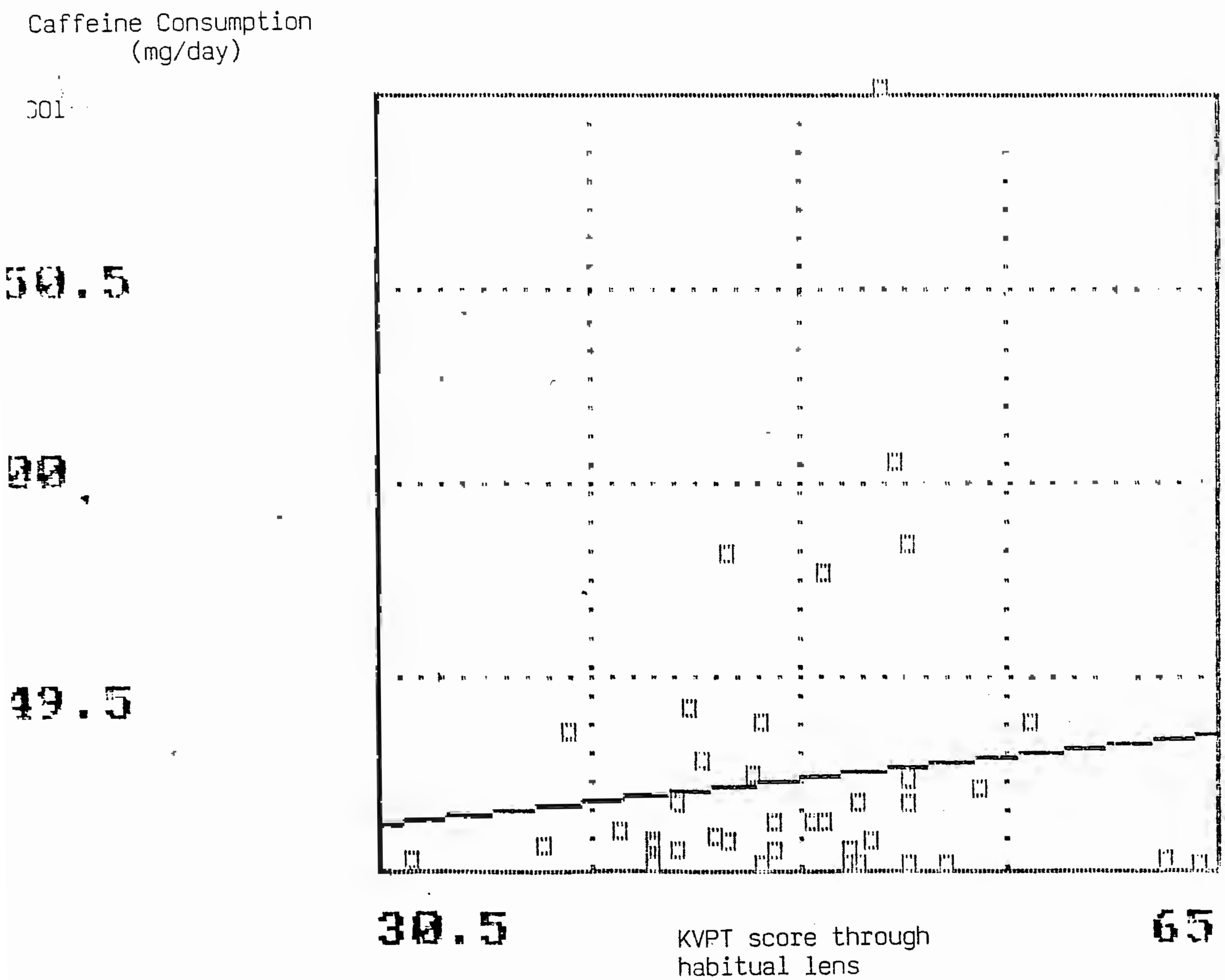
B = Subjects whose speed on the Kirshner Visual Performance Test was $\geq$ 2.0 seconds faster using the habitual plus +0.75 D relative to just the habitual near lens.

Bivariate Statistics

Dependent variable is col(4)	*caffiene consumption (mg/day)*
Independent variable is col(1)	*lens #1 (habitual)*

Number of rows processed	*40*
Number of non-missing rows	*39*
Intercept (a)	*-42.92608*
Slope (b)	*3.409563*
R-Squared	*0.0129*
Correlation Coefficient (r)	*0.1136*
Mean Squared Error (MSE)	*37702.21*
Standard Error of Regression	*194.1705*
Mean of X(1)	*47.42308*
Mean of Y(4)	*118.7659*
Regression Sum of Squares	*18242.95*
Error Sum of Squares	*1394982*
Total Sum of Squares	*1413225*
T-value for testing b=0	*.6956072*
Tail probability for T-test	*0.491*

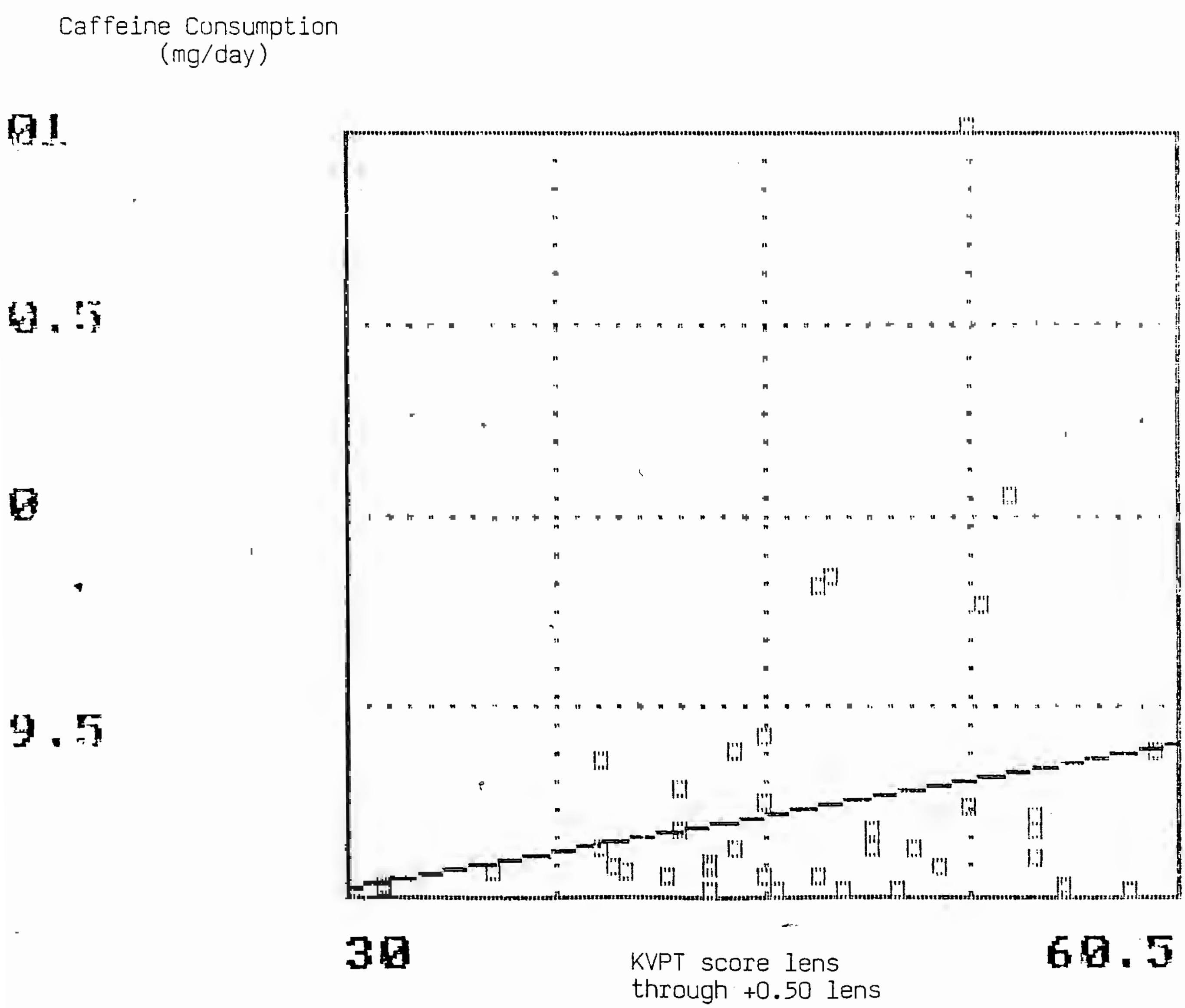
TABLE #12



Dependent variable is col(4) caffiene consumption (mg/day)
Independent variable is col(2) lens #2 (.50)

Number of rows processed	*40*
Number of non-missing rows	*39*
Intercept (a)	*-178.032*
Slope (b)	*6.280585*
R-Squared	*0.0457*
Correlation Coefficient (r)	*0.2139*
Mean Squared Error (MSE)	*36447.99*
Standard Error of Regression	*190.9136*
Mean of X(2)	*47.25641*
Mean of Y(4)	*118.7659*
Regression Sum of Squares	*64649.05*
Error Sum of Squares	*1348576*
Total Sum of Squares	*1413225*
T-value for testing b=0	*1.331816*
Tail probability for T-test	*0.191*

TABLE #13

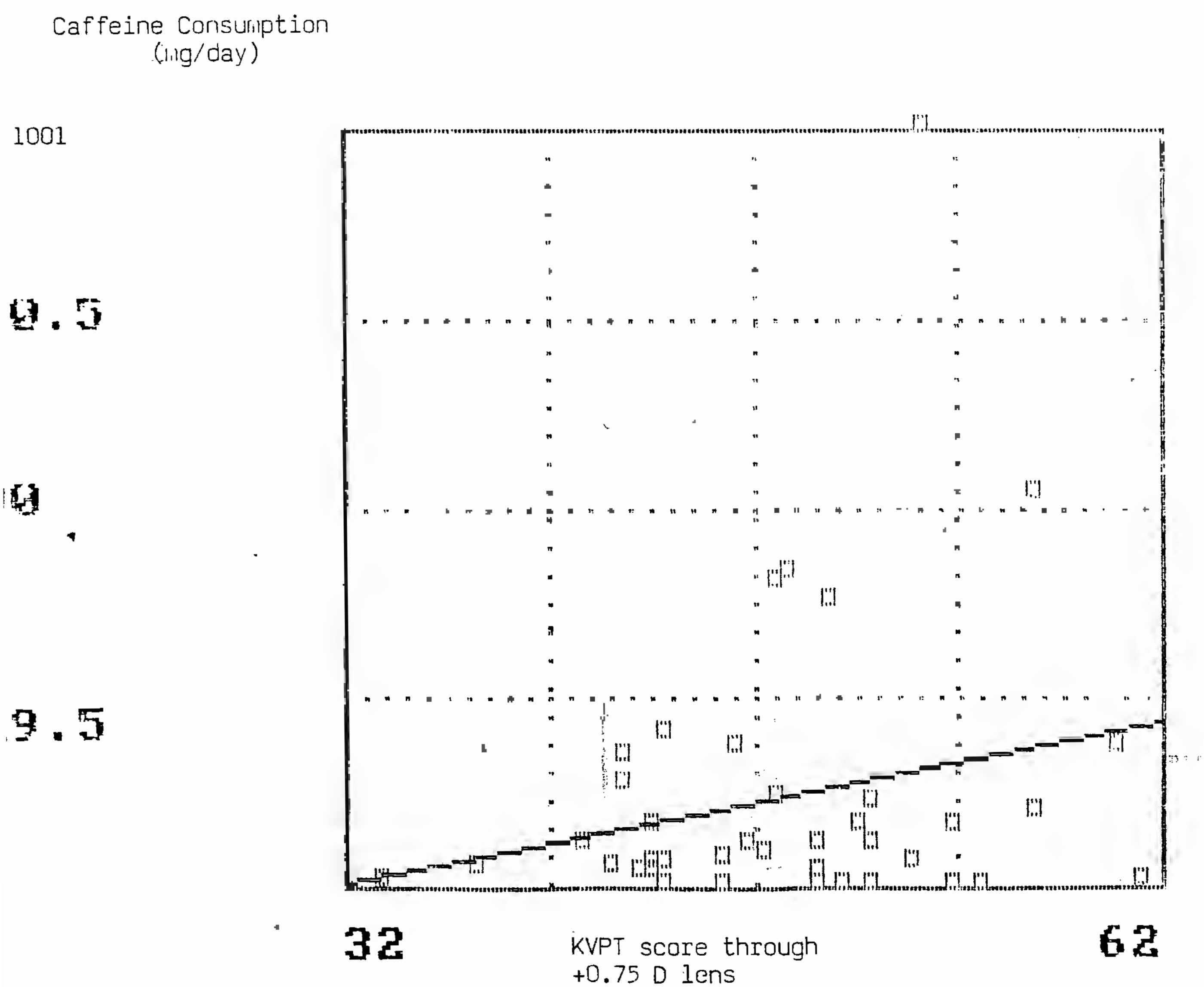


Bivariate Statistics

Dependent variable is col(4) caffiene consumption (mg/day)
Independent variable is col(3) lens #3 (.75)

Number of rows processed	*40*
Number of non-missing rows	*39*
Intercept (a)	*-232.6945*
Slope (b)	*7.351545*
R-Squared	*0.0534*
Correlation Coefficient (r)	*0.2311*
Mean Squared Error (MSE)	*36155.7*
Standard Error of Regression	*190.1465*
Mean of X(3)	*47.80769*
Mean of Y(4)	*118.7659*
Regression Sum of Squares	*75463.75*
Error Sum of Squares	*1337761*
Total Sum of Squares	*1413225*
T-value for testing b=0	*1.44471*
Tail probability for T-test	*0.157*

TABLE #14



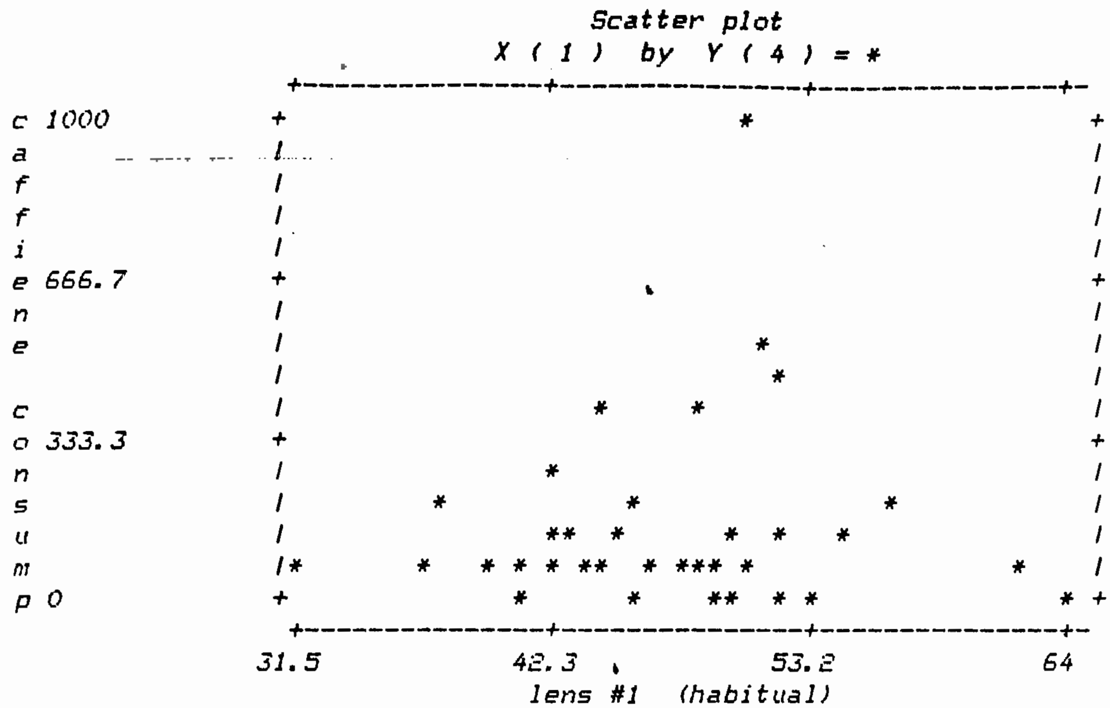


TABLE #15

```
Number of points below minimum        (X) :    0    (Y) :    0
Number of points above maximum        (X) :    0    (Y) :    0
Number of points with missing values  (X) :    0    (Y) :    1
Number of points plotted                  :   39
```

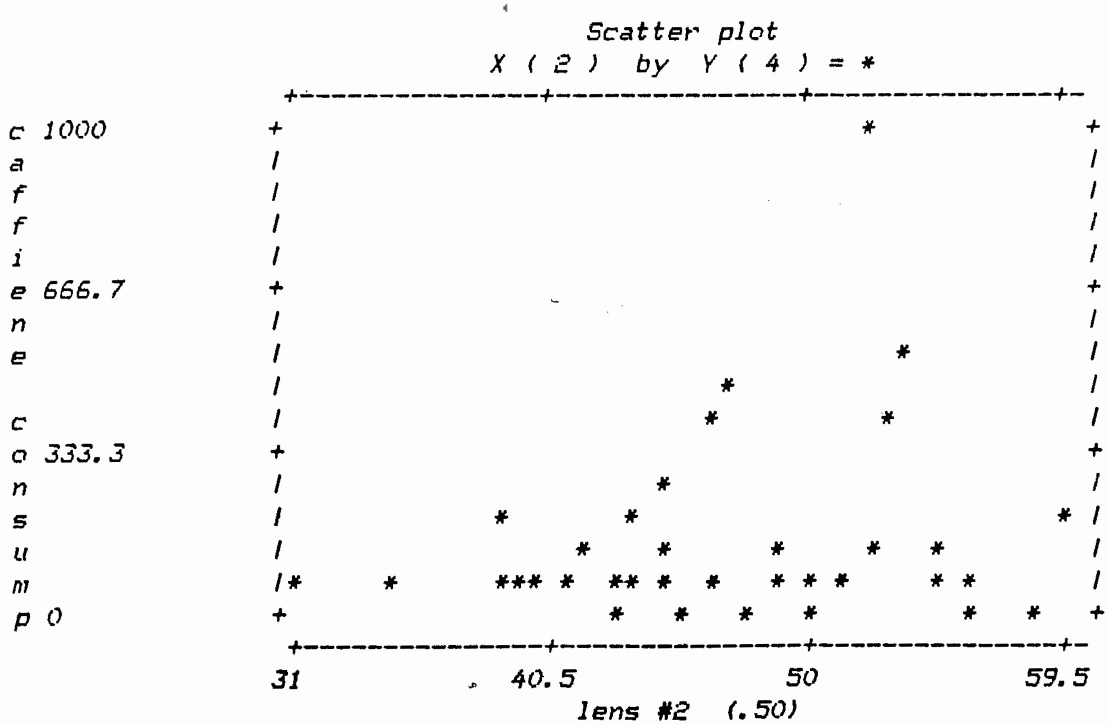
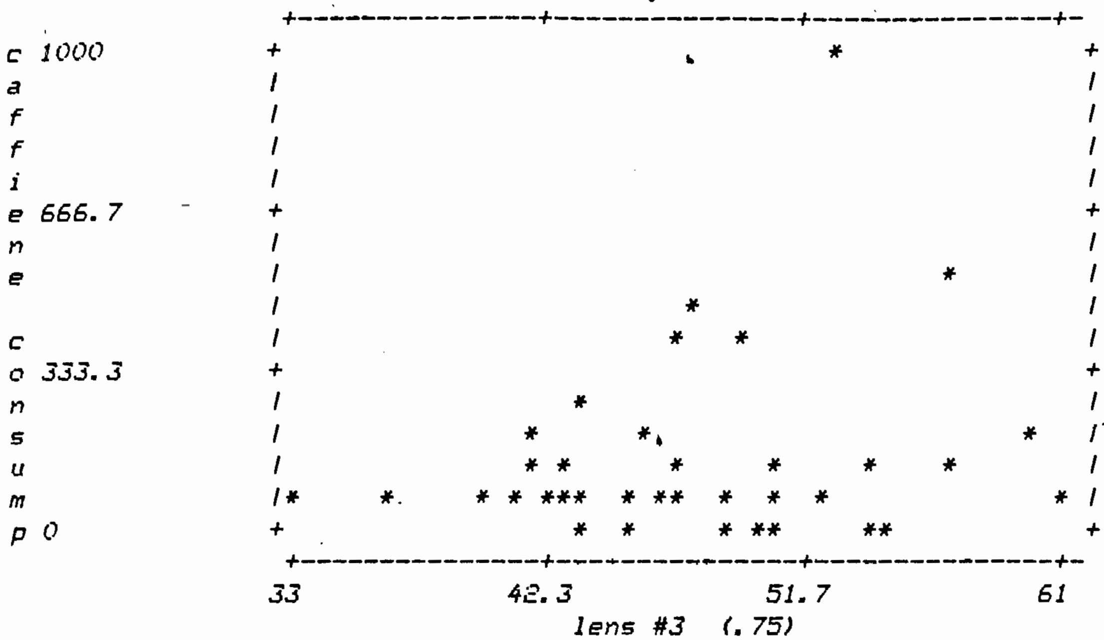


TABLE #16

```
Number of points below minimum        (X) :    0    (Y) :    0
Number of points above maximum        (X) :    0    (Y) :    0
Number of points with missing values  (X) :    0    (Y) :    1
Number of points plotted                  :   39
```

Scatter plot
X (3) by Y (4) = *



Number of points below minimum	(X) :	0	(Y) :	0
Number of points above maximum	(X) :	0	(Y) :	0
Number of points with missing values	(X) :	0	(Y) :	1
Number of points plotted	:	39		

TABLE #17

Univariate Statistics

Column (1) Label: lens #1 (habitual)

Mean - Average	47.2125	Number of Observations	40
Standard Deviation	6.481618	Number of Missing Values	0
Coefficient of Variation	.1372861	Sum of weights	40
Variance	42.01138	Sum of observations	1888.5
Standard Error of Mean	1.024834	Adjusted Sum of Squares	1638.444
T-Value Testing Mean=0	46.06844	Adjusted Sum of Cubes	1640.578
100-%tile (Maximum)	64	Adjusted Sum of Quartics	1641.192
90-%tile	54.25	Coefficient of Skewness	2.473714E-02
75-%tile	51.25	Coefficient of Kurtosis	6.113589E-04
50-%tile (Median)	46.5	Range	32.5
25-%tile	42.75	Inner Quartile Range	8.5
10-%tile	39		
0-%tile (Minimum)	31.5		

Frequency Distribution

Group	Freq	%Freq	Cum.Freq.	%Cum.Freq.	Midpoint	Histogram
1	1	2.5	1	2.5	32.85E+00	:*
2	0	0.0	1	2.5	35.56E+00	:
3	3	7.5	4	10.0	38.27E+00	:***
4	4	10.0	8	20.0	40.98E+00	:****
5	7	17.5	15	37.5	43.69E+00	:*******
6	6	15.0	21	52.5	46.40E+00	:******
7	7	17.5	28	70.0	49.10E+00	:*******
8	7	17.5	35	87.5	51.81E+00	:*******
9	2	5.0	37	92.5	54.52E+00	:**
10	1	2.5	38	95.0	57.23E+00	:*
11	0	0.0	38	95.0	59.94E+00	:
12	2	5.0	40	100.0	62.65E+00	:**

TABLE #18

Univariate Statistics

Column (2) Label: lens #2 (.50)

Mean - Average	47.075	Number of Observations	40
Standard Deviation	6.583342	Number of Missing Values	0
Coefficient of Variation	.1398479	Sum of weights	40
Variance	43.34039	Sum of observations	1883
Standard Error of Mean	1.040918	Adjusted Sum of Squares	1690.275
T-Value Testing Mean=0	45.22452	Adjusted Sum of Cubes	1697.408
100-%tile (Maximum)	59.5	Adjusted Sum of Quartics	1704.007
90-%tile	55.5	Coefficient of Skewness	2.442588E-02
75-%tile	52.5	Coefficient of Kurtosis	5.96426E-04
50-%tile (Median)	47	Range	28.5
25-%tile	42.5	Inner Quartile Range	10
10-%tile	39		
0-%tile (Minimum)	31		

Frequency Distribution

Group	Freq	%Freq	Cum.Freq.	%Cum.Freq.	Midpoint	Histogram
1	1	2.5	1	2.5	32.19E+00	:*
2	1	2.5	2	5.0	34.56E+00	:*
3	0	0.0	2	5.0	36.94E+00	:
4	5	12.5	7	17.5	39.31E+00	:*****
5	3	7.5	10	25.0	41.69E+00	:***
6	8	20.0	18	45.0	44.06E+00	:********
7	4	10.0	22	55.0	46.44E+00	:****
8	3	7.5	25	62.5	48.81E+00	:***
9	4	10.0	29	72.5	51.19E+00	:****
10	4	10.0	33	82.5	53.56E+00	:****
11	5	12.5	38	95.0	55.94E+00	:*****
12	2	5.0	40	100.0	58.31E+00	:**

TABLE #19

Univariate Statistics

Column (3) Label: lens #3 (.75)

Mean - Average	47.6375	Number of Observations	40
Standard Deviation	6.079587	Number of Missing Values	0
Coefficient of Variation	.1276219	Sum of weights	40
Variance	36.96138	Sum of observations	1905.5
Standard Error of Mean	.9612671	Adjusted Sum of Squares	1441.494
T-Value Testing Mean=0	49.55698	Adjusted Sum of Cubes	1444.023
100-%tile (Maximum)	61	Adjusted Sum of Quartics	1444.94
90-%tile	56	Coefficient of Skewness	2.638487E-02
75-%tile	51	Coefficient of Kurtosis	6.953834E-04
50-%tile (Median)	47.5	Range	28
25-%tile	43	Inner Quartile Range	8
10-%tile	41		
0-%tile (Minimum)	33		

Frequency Distribution

Group	Freq	%Freq	Cum.Freq.	%Cum.Freq.	Midpoint	Histogram
1	1	2.5	1	2.5	34.17E+00	:*
2	1	2.5	2	5.0	36.50E+00	:*
3	0	0.0	2	5.0	38.83E+00	:
4	5	12.5	7	17.5	41.17E+00	:*****
5	7	17.5	14	35.0	43.50E+00	:*******
6	4	10.0	18	45.0	45.83E+00	:****
7	7	17.5	25	62.5	48.17E+00	:*******
8	6	15.0	31	77.5	50.50E+00	:******
9	2	5.0	33	82.5	52.83E+00	:**
10	3	7.5	36	90.0	55.17E+00	:***
11	2	5.0	38	95.0	57.50E+00	:**
12	2	5.0	40	100.0	59.83E+00	:**

TABLE #20

Univariate Statistics

Column (4) Label: caffiene consumption (mg/day)

Mean - Average	118.7659	Number of Observations	40
Standard Deviation	192.8474	Number of Missing Values	1
Coefficient of Variation	1.623761	Sum of weights	39
Variance	37190.13	Sum of observations	4631.87
Standard Error of Mean	30.8803	Adjusted Sum of Squares	1413225
T-Value Testing Mean=0	3.846009	Adjusted Sum of Cubes	1177586
100-%tile (Maximum)	1000	Adjusted Sum of Quartics	1.596765E+07
90-%tile	385.715	Coefficient of Skewness	7.00932E-04
75-%tile	133.29	Coefficient of Kurtosis	7.995001E-06
50-%tile (Median)	53	Range	1000
25-%tile	16.43	Inner Quartile Range	116.86
10-%tile	0		
0-%tile (Minimum)	0		

Frequency Distribution

Group	Freq	%Freq	Cum.Freq.	%Cum.Freq.	Midpoint	Histogram
1	26	66.7	26	66.7	41.67E+00	:*************
2	4	10.3	30	76.9	12.50E+01	:**
3	4	10.3	34	87.2	20.83E+01	:**
4	0	0.0	34	87.2	29.17E+01	:
5	3	7.7	37	94.9	37.50E+01	:**
6	0	0.0	37	94.9	45.83E+01	:
7	1	2.6	38	97.4	54.17E+01	:*
8	0	0.0	38	97.4	62.50E+01	:
9	0	0.0	38	97.4	70.83E+01	:
10	0	0.0	38	97.4	79.17E+01	:
11	0	0.0	38	97.4	87.50E+01	:
12	1	2.6	39	100.0	95.83E+01	:*

TABLE #21

CONCLUSION

We believe this research is clinically significant and further investigation is indicated. By understanding the effect of caffeine of near point plus lens acceptance, the optometrist can more accurately determine which patients will benefit from stress relieving lenses. As our understanding of the effect that diet has on the visual system increases, the optometrist may eventually consider the nutrition habits of patients when deciding upon the prescription and/or choice of therapy. By adding to our knowledge of the many variables effecting human visual function, we will improve our ability to prescribe beneficial regiments of therapy.

Our findings are not consistent with earlier research done by Dr. Kirshner. Before further testing is done, we recommend that several critical components of our research design be closely evaluated. For example, it is not our opinion that the KVPT has adequately been proven to be an accurate measurement of near point plus acceptance. Also, an average measurement of near point plus acceptance. Also, an average daily caffeine consumption value may not be a good indicator of the amount of caffeine in the subject's system at the time of testing. For better statistical control, we suggest blood testing just before or after administration of the KVPT.

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