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Short Communication

Cholesterol and Diet in Cancer Survivors: A Double-blind, Retrospective Case Series of 255 Cancer Patients in a Naturopathic Clinic

Huber C* and Waters RF

Naturopathic Medical Doctors of Arizona, USA

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Abstract

317 cancer patients have been treated intensively at our clinic over the last seven years. Of those, we have data on diet and/or cholesterol on the initial intake for 255 patients. Of those 255, we compare those that survived to the present (192) and those that died from all causes (63). Significant difference was found in the serum cholesterol as well as the chosen diet of cancer survivors vs deceased cancer patients.

Introduction

Recent recommendations for the more widespread prescription of statin drugs in the U.S. have generated controversy. Cholesterol is commonly thought to be the enemy of good health. Higher cholesterol has been alleged to be associated with pathologies, such as cardiovascular disease, not with higher survival.

However, there is a history of research showing correlation between low serum cholesterol and cancer in general [1,2], as well as colon cancer in 8006 men [3].

Cancer (without regard to type) has been shown to be especially prevalent in the lowest cohort of serum cholesterol in this very large study: 361,662 men aged 35 to 57 years, reported in JAMA: "Mortality follow-up revealed a significant excess of cancer in the lowest decile of serum cholesterol level during the early years of the follow-up, which attenuated over time" [4].

Cholesterol is the main known substrate in the body's production of Vitamin D, specifically cholecalciferol, as well as steroid hormones, some of which have been shown to have anti-cancer effect.

We compared total serum cholesterol (TC) in cancer survivors vs cancer fatalities, and we assess the value of deliberately lowering TC among cancer patients.

We also examined diet in the survivors as well as those who then died of cancer.

Methods

In this original, previously unpublished research, we conducted a double-blind retrospective case series, in which we looked back at data from all 255 cancer patients who came to and were treated by our clinic with either current dietary information, based on a self-chosen diet, and/or a recent (last six months) serum TC level, measured by an unaffiliated laboratory or an unaffiliated clinic over the previous seven years, comparing TC in the surviving cancer patients versus those cancer patients who died during that same time.

The 255 patients include those that survived to the present (192) and those that died from all causes (63). Some patients did not die of cancer. A few died of surgical complications. One had a myocardial infarction while hiking on a mountain. Some cases of precipitous morbidity and mortality were closely following rounds of chemotherapy. Those now deceased were more likely to have cholesterol measured than survivors, due to our ever more urgent search in their last months for any information that could possibly help them. Therefore, the deceased are over-represented in the cohort of 255 patients with the data of interest.

Findings

Surviving cancer patients had 24 points higher mean total cholesterol than the

***Corresponding author:** Huber C, Naturopathic Medical Doctors of Arizona, USA, Tel: (480) 839-2800, Email: ch@naturopathyworks.com

mean for deceased cancer patients (Table 1).

Some patients were found to be at the extreme ends of the distribution. Of those now deceased, outlying data was found at the extreme lower end of TC values, whereas of the survivors, there were some values at the extreme high end.

So we then decided to look at TC values of 50 < x < 300. This excluded four of the sickest patients our clinic has ever encountered, two of them with a cholesterol of 3, one with a cholesterol of 28 and one with a cholesterol of 36, the last two confined to wheelchairs. We also excluded one with a cholesterol of 428 (who frequently hikes mountains); another with TC = 397, who gardens for hours and climbs ladders at age 84, and another with TC = 308, an active person.

Limiting the field this way, we had the following averages:

We used Inductive Rule Extraction in order to observe any correlations that may exist in the data. Data analysis was performed using SPSS™ statistical analysis software. HIPAA compliance was followed to ensure patient anonymity associated with the data used in the bio-statistical analysis. Standard Bivariate Correlation Analysis was used to compare the data, and standard levels of statistical significance were determined that are typically used and reported in biological systems (e.g. $p < .05$). Analysis of the data is reported as Bivariate Comparison, Pearson Correlation, Significance, and the number of "n" used in the comparison. The variation in "n" is due to some "missing values" associated with the some of the bivariate comparisons (Table 2).

The following Table 3 shows the results of these comparisons:

Comparing diet and cholesterol, there is a higher mean level of cholesterol with the omnivore (OM) diet (189) compared to the Vegan (Vegan) and Vegetarian (Veg) diets (168 and 167 respectively).

The results in Table 4 may be skewed by the phenomenon of cancer patients arriving to treatment at our clinic in various stages of cancer. Those who were relatively healthier may have had the luxury of choosing a vegan diet, whereas those who were worse off may have tried to obtain sustenance and calories any way they could. Therefore, it is conceivable that some of the most ill individuals may have chosen an omnivorous diet.

Comparing cholesterol with diet

There is a significant correlation of cholesterol level and diet (omnivore). One possible reason is that in the omnivore, dietary consumption of cholesterol can be significantly high. However, high consumption of carbohydrates may cause hypercholesterolemia in vegan and vegetarian diets as well.

There is a correlation between lower cholesterol levels and higher stages of cancer

The higher the cancer stage the significantly lower the cholesterol level. This raises the question of why lower cholesterol would be correlated with lower survival rate. More detailed research has to be done to elucidate the "cholesterol factor" and cancer survival. If it is not diet specific, then there may be a uniquely physiological phenomenon in cancer pathologies.

Observations of survival and diet

We may ask: if there is a significant correlation between survival and high cholesterol, is there also a significant correlation between survival and diet? Dietary differences between cancer survivors and those who later died of cancer were also found to be notable. If we look at probability of survival, then the omnivores were significantly more likely to survive than the other two groups.

Table 5 shows that among these cancer patients omnivores were 3.6 times more likely to survive than to die. But vegetarians were only 2.1 times more likely to survive than to die, and vegans were only 1.6 times more likely to survive than to die.

	Mean TC
Surviving cancer patients	191
Deceased cancer patients	167
Difference	24

Table 1: Comparison of TC in survivor vs deceased cancer patients.

	Mean TC
Surviving cancer patients	187
Deceased cancer patients	177
Difference	10

Table 2: Comparison of TC in survivor vs deceased cancer patients, without outlying data points.

Bivariate Comparison	Pearson Correlation		Significance 2-Tailed	n
Cholesterol/Survival	-0.205	**	0.001	213
Cholesterol/Diet	-0.158	*	0.022	213
Cancer Stage/Survival	0.470	**	0.000	216
Cholesterol/Cancer Stage	-0.181	**	0.008	213

* = P < .05 ** = P< .01

Table 3: Bivariate Correlations.

	Mean TC	Minimum TC	Maximum TC
Omnivore	189	3	428
Vegan	168	28	259
Vegetarian	167	3	255

Table 4: Diet and total serum cholesterol.

	n	Ratio survivors to deceased
Living vegan	21	
Dead vegan	13	1.6
Living vegetarian	15	
Dead vegetarian	7	2.1
Living omnivore	156	
Dead omnivore	43	3.6
Ratio all survivors to all deceased		3.0

Table 5: Survival with respect to diet.

Statistical Details

Descriptive Statistics

	Mean	Std. Deviation	N
Cholesterol	183.63	53.619	213
Dead or Alive	1.29	.456	216

Correlations

		Cholesterol	Dead or Alive
Cholesterol	Pearson Correlation	1	-.205**
	Sig. (1-tailed)	.	.001
	Sum of Squares and Cross-products	609489.437	-1063.930
	Covariance	2874.950	-5.019
	N	213	213
Dead or Alive	Pearson Correlation	-.205**	1
	Sig. (1-tailed)	.001	.
	Sum of Squares and Cross-products	-1063.930	44.625
	Covariance	-5.019	.208
	N	213	216

**. Correlation is significant at the 0.01 level (1-tailed).

Associated Non-Parametric Correlations

Correlations

			Cholesterol	Dead or Alive
Spearman□sho	Cholesterol	Correlation Coefficient	1.000	-.172**
		Sig. (1-tailed)	.	.006
		N	213	213
	Dead or Alive	Correlation Coefficient	-.172**	1.000
		Sig. (1-tailed)	.006	.
		N	213	216

**. Correlation is significant at the 0.01 level (1-tailed).

Table 6: Cholesterol and Survivorship (Death) have a Significant Negative Correlation.

Descriptive Statistics

	Mean	Std. Deviation	N
Cholesterol	183.63	53.619	213
Diet	1.31	.622	255

Correlations

		Cholesterol	Diet
Cholesterol	Pearson Correlation	1	-.158*
	Sig. (2-tailed)	.	.022
	Sum of Squares and Cross-products	609489.437	-1149.957
	Covariance	2874.950	-5.502
	N	213	210
Diet	Pearson Correlation	-.158*	1
	Sig. (2-tailed)	.022	.
	Sum of Squares and Cross-products	-1149.957	98.141
	Covariance	-5.502	.386
	N	210	255

*. Correlation is significant at the 0.05 level (2-tailed).

Non-Parametric Correlations

Correlations

			Cholesterol	Diet
Spearman's rho	Cholesterol	Correlation Coefficient	1.000	-.157*
		Sig. (2-tailed)	.	.022
		N	213	210
	Diet	Correlation Coefficient	-.157*	1.000
		Sig. (2-tailed)	.022	.
		N	210	255

Table 7: Comparing Cholesterol with diet. Significant correlation of cholesterol level and diet. This may be assumed with the omnivore type diet where consumption of cholesterol may be significantly high.

Non-Parametric Correlations

Descriptive Statistics

	Mean	Std. Deviation	N
Dead or Alive	1.29	.456	216
Gender	1.62	.487	258

Correlations

		Dead or Alive	Gender
Dead or Alive	Pearson Correlation	1	-.014
	Sig. (2-tailed)	.	.835
	Sum of Squares and Cross-products	44.625	-.679
	Covariance	.208	-.003
	N	216	215
Gender	Pearson Correlation	-.014	1
	Sig. (2-tailed)	.835	.
	Sum of Squares and Cross-products	-.679	61.012
	Covariance	-.003	.237
	N	215	258

Non-Parametric Correlations

Correlations

			Dead or Alive	Gender
Spearman's rho	Dead or Alive	Correlation Coefficient	1.000	-.014
		Sig. (2-tailed)	.	.835
		N	216	215
	Gender	Correlation Coefficient	-.014	1.000
		Sig. (2-tailed)	.835	.
		N	215	258

Table 8: A non-significant correlation exists in these data between survival and gender

Non-Parametric Correlations

Descriptive Statistics

	Mean	Std. Deviation	N
Cancer Stage	3.26	2.282	259
Dead or Alive	1.29	.456	216

Descriptive Statistics

	Mean	Std. Deviation	N
Dead or Alive	1.29	.456	216
Gender	1.62	.487	258

Correlations

		Dead or Alive	Gender
Dead or Alive	Pearson Correlation	1	-.014
	Sig. (2-tailed)	.	.835
	Sum of Squares and Cross-products	44.625	-.679
	Covariance	.208	-.003
	N	216	215
Gender	Pearson Correlation	-.014	1
	Sig. (2-tailed)	.835	.
	Sum of Squares and Cross-products	-.679	61.012
	Covariance	-.003	.237
	N	215	258

Non-Parametric Correlations

Correlations

			Dead or Alive	Gender
Spearman's rho	Dead or Alive	Correlation Coefficient	1.000	-.014
		Sig. (2-tailed)	.	.835
		N	216	215
	Gender	Correlation Coefficient	-.014	1.000
		Sig. (2-tailed)	.835	.
		N	215	258

Table 9: An expected very high correlation between survival (death) and stage of cancer.

Non-Parametric Correlations

Descriptive Statistics

	Mean	Std. Deviation	N
Diet	1.31	.622	255
Gender	1.62	.487	258

Correlations

		Diet	Gender
Diet	Pearson Correlation	1	.045
	Sig. (2-tailed)	.	.480
	Sum of Squares and Cross-products	98.141	3.406
	Covariance	.386	.013
	N	255	254
Gender	Pearson Correlation	.045	1
	Sig. (2-tailed)	.480	.
	Sum of Squares and Cross-products	3.406	61.012
	Covariance	.013	.237
	N	254	258

Non-Parametric Correlations

Correlations

			Diet	Gender
Spearman's rho	Diet	Correlation Coefficient	1.000	.055
		Sig. (2-tailed)	.	.380
		N	255	254
	Gender	Correlation Coefficient	.055	1.000
		Sig. (2-tailed)	.380	.
		N	254	258

Table 10: These data do not indicate a significant correlation between gender and diet.

Non-Parametric Correlations

Descriptive Statistics

	Mean	Std. Deviation	N
Cholesterol	183.63	53.619	213
Cancer Stage	3.26	2.282	259

Correlations

		Cholesterol	Cancer Stage
Cholesterol	Pearson Correlation	1	-.181**
	Sig. (2-tailed)	.	.008
	Sum of Squares and Cross-products	609489.437	-4703.859
	Covariance	2874.950	-22.188
	N	213	213
Cancer Stage	Pearson Correlation	-.181**	1
	Sig. (2-tailed)	.008	.
	Sum of Squares and Cross-products	-4703.859	1343.668
	Covariance	-22.188	5.208
	N	213	259

**. Correlation is significant at the 0.01 level (2-tailed).

Non-Parametric Correlations

Correlations

			Cholesterol	Cancer Stage
Spearman's rho	Cholesterol	Correlation Coefficient	1.000	-.163*
		Sig. (2-tailed)	.	.017
		N	213	213
	Cancer Stage	Correlation Coefficient	-.163*	1.000
		Sig. (2-tailed)	.017	.
		N	213	259

*. Correlation is significant at the 0.05 level (2-tailed).

Table 11: There is a negative correlation between cholesterol levels and stage of cancer. The higher the cancer stage the significantly lower the cholesterol level. Higher stage seems to correlate with lower cholesterol and lower survival rate. More detailed research has to be done to elucidate the "cholesterol factor".

Non-Parametric Correlations

Descriptive Statistics

	Mean	Std. Deviation	N
Diet	1.31	.622	255
Dead or Alive	1.29	.456	216

Correlations

		Diet	Dead or Alive
Diet	Pearson Correlation	1	.096
	Sig. (2-tailed)	.	.161
	Sum of Squares and Cross-products	98.141	6.000
	Covariance	.386	.028
	N	255	213
Dead or Alive	Pearson Correlation	.096	1
	Sig. (2-tailed)	.161	.
	Sum of Squares and Cross-products	6.000	44.625
	Covariance	.028	.208
	N	213	216

Non-Parametric Correlations

Correlations

			Diet	Dead or Alive
Spearman's rho	Diet	Correlation Coefficient	1.000	.113
		Sig. (2-tailed)	.	.101
		N	255	213
	Dead or Alive	Correlation Coefficient	.113	1.000
		Sig. (2-tailed)	.101	.
		N	213	216

Table 12: These data do not indicate a significant correlation between survival and diet.

Non-Parametric Correlations

Conclusion

These results suggest that considerably more research has to be done with regard to cholesterol levels, diet and cancer survivorship to determine if there is a cause and effect relationship that may be used by the physician to increase survival rates during the treatment process. It is possible that patients with Type II Familial Hypercholesterolemia (dyslipidemia) taking statin type medication may have diminished Vitamin D production and endocrine function reduction, which may be very problematic in cancer patient survival. In the meantime, caution should be used before prescription of statin drugs to cancer patients, or before insisting on a vegan diet with cancer patients.

GLOSSARY of statistical terms

Co-variance: How much do two random variables change together? Answer:

$\sigma(x, y) = \mathrm{E}\left[(x - \mathrm{E}[x])(y - \mathrm{E}[y])\right]$, where E is the expected value or mean.

Pearson's Correlation Co-efficient: Covariance of two variables divided by the product of their standard deviations.

$$\rho_{X,Y} = \frac{\operatorname{cov}(X,Y)}{\sigma_X \sigma_Y} = \frac{E[(X - \mu_X)(Y - \mu_Y)]}{\sigma_X \sigma_Y}$$

Null Hypothesis: Two different variables are probably not correlated, assumed to be not, till proven correlated. i.e. "Aspirin has no proven effect on headache."

Statistical significance is the probability that an effect is not likely due to chance alone. This can cast doubt on the null hypothesis.

Two-Tailed test: a way of computing the statistical significance of two extreme ends of a bell curve

P-Value: probability of obtaining a test statistic at least as extreme as the one that was actually observed.

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