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The effects of aerobic dance and relaxation therapy on intraocular pressure and blood pressure

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Abstract

The ability of different forms of aerobic exercise to reduce intraocular pressure (IOP) has been reported. This investigation studied the effects on IOP due to physical exercise on a short-term basis. Thirteen adult subjects enrolled in an aerobic dance class were measured once a week, before and after a one-hour exercise session, for IOP, systolic, and diastolic blood pressures. A second group consisted of five adults taking a relaxation therapy class. The same measurements were collected from these subjects. For both groups, measurements were obtained over five weeks. Results from two factor analysis of variance for each individual group showed no significant decrease in IOP or blood pressures at the $p < .05$ level. It was therefore concluded that neither short term exercise programs such as aerobic dancing nor relaxation therapy could alter IOP or blood pressures significantly under the conditions existent in this study.

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Norman S. Stern

Subject Categories

Optometry

THE EFFECTS OF AEROBIC DANCE AND RELAXATION THERAPY ON INTRAOCULAR PRESSURE AND BLOOD PRESSURE

by

Kathleen Kopecko Avrel Nudelman

A Thesis Presented to the

Faculty of Pacific University College of Optometry

Faculty Advisor: Norman S. Stern, O.D., Ph.D.

In Partial Fulfillment of

the Requirements for the Degree

Doctor of Optometry

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ABSTRACT

The ability of different forms of aerobic exercise to reduce intraocular pressure (IOP) has been reported. This investigation studied the effects on IOP due to physical exercise on a short-term basis. Thirteen adult subjects enrolled in an aerobic dance class were measured once a week, before and after a one-hour exercise session, for IOP, systolic, and diastolic blood pressures. A second group consisted of five adults taking a relaxation therapy class. The same measurements were collected from these subjects. For both groups, measurements were obtained over five weeks. Results from two factor analysis of variance for each individual group showed no significant decrease in IOP or blood pressures at the $p < .05$ level. It was therefore concluded that neither short term exercise programs such as aerobic dancing nor relaxation therapy could alter IOP or blood pressures significantly under the conditions existent in this study.

INTRODUCTION

This study investigated the change in IOP and blood pressure with a specific type of exercise and relaxation therapy. A number of studies have shown that the immediate effects of physical exercise are a lowering of IOP, an immediate rise of systolic blood pressure, an immediate decrease of diastolic blood pressure, and a long term lowering of both systolic and diastolic blood pressures.[6,7,10,14,15,16] There were no published studies found relating IOP to stress-reduction related activities. However, since some literature mentions a direct linear relation between IOP and blood pressure, our hypothesis was that if physical exercise and tension-relieving activities affect blood pressure, they may also affect the IOP.

Methodology employed in this study consisted of taking IOP and blood pressure measurements on adults enrolled in aerobic dancing and stress management classes offered through Portland Community College in Washington County. The classes were held between April and October of 1981. IOP was measured, using the American Optical non-contact Tonometer (AONCT). Blood pressure measurements were taken with a mercury sphingomamometer and blood pressure cuff, using the auscultatory technique.

LITERATURE REVIEW

Reese and McGavic[1] first used an index which showed the relationship of systemic blood pressure to intraocular pressure. It was computed as BP/IOP. The index using systolic BP in the numerator, is said to be within normal if it is greater than or equal to 5.75. If diastolic BP is in the numerator, a normal index is greater than or

equal to 3.25. Daubs[2] did a study on the index to determine its accuracy. He found that 80% of glaucomatous patients did show abnormal indeces using systolic BP as the numerator.

In a study by Leighton and Philips,[3] BP and IOP were measured in three different groups: those who had normal IOP, those with open-angle glaucoma, and those with low tension glaucoma. They found both systolic and diastolic pressures to be significantly greater in open-angle glaucoma subjects than in subjects suffering from low tension glaucoma. The difference was more significant for diastolic than systolic pressure. Both the systolic and diastolic pressures were greater in open-angle glaucoma than in the normal control group. In comparing low tension glaucoma to open-angle glaucoma, the higher the IOP, the higher was the diastolic blood pressure to a high level of significance. The explanation given for the association between IOP and blood pressure was that the capillary circulation at the disc may be more precarious the higher the blood pressure.

In a paper by Cullen, Sharp, Moore and McCoy,[4] the IOP of 259 subjects was compared with their systemic blood pressure. The study showed a directly proportional relation between intraocular pressure and blood pressure. It is important to note that none of the subjects in the Cullen, et al study were considered to have glaucoma as did none of the subjects in our study. Therefore, a correlation between intraocular pressure and blood pressure in non-glaucomatous subjects may also exist.

A study done on 16,000 subjects taken from an elderly population (mean age = 72) was done in London by Bulpitt, et al.[5] The study showed systemic blood pressure as measured on the arm to be positively

and independently (of sex, age, weight, and height) correlated with intraocular pressure. It was stated that for a 100 mmHg increase in systemic pressure there was a 2 mmHg increase in intraocular pressure. Although this was not clinically significant, the association does indicate a functional relationship between systemic blood pressure and intraocular pressure. Four mechanisms were proposed for the intraocular pressure increase seen with systemic blood pressure increase:[5]

(1) an increased retinal blood volume due to increased central retinal vein pressure because of increased pressure in the adjacent central retinal artery.

(2) increased resistance in the episcleral and anterior ciliary veins causing increased blood volume in the ciliary body and decreased facility of aqueous outflow.

(3) increased perfusion pressure in the ciliary arteries causing increased filtration of aqueous fluid in the ciliary body.

(4) aqueous drainage blockage at the anterior chamber angle.

Comparing figures, the Leighton and Philips study[3] showed an increase of 1 mmHg intraocular pressure for every 1 mmHg increase of perfusion pressure. Cullen, et al[4] found a 6-7 mmHg increase in intraocular pressure for a 100 mmHg increase in systemic blood pressure. The Bulpitt study[5] was also like this present one in that the majority of subjects had neither what would be considered hypertension nor glaucoma.

Since the previous discussion has established reasons for measuring blood pressure along with intraocular pressure, the topic of exercise in relation to the other two variables becomes relevant. As early as 1967 the effect of exercise on intraocular pressure was being studied by Lempert, Cooper, et al.[6] The purpose of this study was to

further investigate the variation in IOP following uniformly strenuous exercise as measured on individuals in various states of physical fitness. Subjects were exercised on a treadmill and ran either to exhaustion or until a pulse of 180 beats/minute was reached. The subjects were 19 males. Measurements were taken with a Schiotz tonometer prior to and as soon as possible after exercise--usually within two minutes. All of the subjects showed a marked increase in systemic blood pressure after exercise and a post exercise drop in IOP. The fall in IOP was shown to occur despite differences in age, physical condition, or initial IOP. Those subjects in the glaucoma and preglaucoma categories had a greater drop in IOP and one of longer duration than the normals did. In the normals there was a gradual return to the pre-exercise level over a 1-2 hour period following exercise. Interestingly, it was mentioned in the paper that weight lifting is the only known exercise producing an elevation in IOP.

Stewart, et al[7] performed a study that showed a consistent decrease in IOP following exercise. A number of possible explanations were cited. One was that exercise increases systemic fibrinolytic activity which may assist in preventing obstruction of the aqueous outflow path.

Exercise increases circulating epinephrine and this may be what alters IOP. To rule out epinephrine as the causative factor, the experimentors treated one eye only with epinephrine in order to saturate responsive sites to the drug. Therefore, the epinephrine-treated eyes showed lower resting IOP's than the controls. But after exercise, no significant difference occurred between the two eyes in percentage of decrease of IOP. This proved it was not epinephrine but the exercise

itself which influenced aqueous dynamics in the eye.

In a similar way, corticosteroids as a factor decreasing the facility of outflow were tested. Once again, corticosteroids were shown to do little in altering the response of outflow to exercise alone.

Serum osmolarity increases after exercise. When compared with the effect of doses of oral glycerin small enough to simulate the osmolarity changes that come about with exercise, it was found that exercise induced greater changes in IOP than did glycerin for the same amount of change in serum osmolarity. Factors other than serum osmolarity were said to be significant in decreasing IOP after exercise. The exercise employed in the Stewart study[7] was running up and down a flight of stairs until an elevation of pulse of 100 beats/minute was reached as an arbitrary endpoint. Blood pressure and tonometry measurements were taken before and after exercise.

In 1970, Marcus, Krupin, et al[8] did a study in which twelve subjects exercised on a treadmill jogger for four minutes and were measured after for IOP, blood pressure, and pulse. Blood pressure samples were also taken. There was a mean fall in IOP of 5.9 mmHg immediately after exercise which was highly significant ($P < .001$). Blood lactate rose, plasma osmolarity rose, and blood pH fell. All parameters returned to baseline values within an hour after exercise. Systolic blood pressure rose immediately after exercise and diastolic blood pressure fell. Pulse rate increased immediately after exercise. This study confirmed the fall in IOP in human beings seen after exercise. A greater decrease in IOP after exercise compared to the decrease seen in lactate infusion may be accounted for by the acidosis accompanying lactic acid production with exercise. The decrease in IOP was not associated with changes in

outflow facility or episcleral venous pressure as the Stewart study reasoned. A subsequent study by the same investigators and done in a similar manner, only using rabbits as the subjects,[9] led the experimentors to the conclusion that the decrease in blood pH and the increase in plasma osmolarity after exercise were the two factors which contributed to the decrease in IOP in rabbits following physical exertion.

The effects on IOP of walking versus sitting were compared in a study by Leighton and Philips.[10] Goldmann tonometry was performed on 14 subjects after sitting 50 minutes and then after sitting another 50 minutes. On another day, the same subjects were measured first after sitting 50 minutes and then after walking briskly for 50 minutes. The major finding was that there had been a significant fall ($P < .01$) in both eyes after walking compared to after sitting. The decrease was said to have had to do with a reduction in jugular venous pressure. Another finding was that the higher the IOP before walking, the greater was its decrease after walking. However, the authors also made a point of stating that it cannot be assumed that because healthy normal subjects respond to walking by a reduction in IOP, that adult patients with open or even closed-angle glaucoma would respond similarly.

Leighton demonstrated in a later study[11] the effect on IOP of a walk along an urban road compared to sitting, in twelve patients who had open-angle glaucoma. A mean fall in IOP of 4.5 mmHg was found after sitting, but the fall after walking was significantly greater. The mean systolic blood pressure fell significantly after walking but not after sitting.

Following more along the lines of this present study, was one done in 1974 by K.J. Myers.[12] Two aerobic exercises, bicycle ergometry,

and marathon running were employed in the Myers study. IOP was measured with an AO non-contact tonometer, the instrument used in this current study. Following bicycle ergometry there was an average initial IOP decline of 1.54 mmHg on 16 male subjects. This was significant (corresponding to a t-value of $t_{15} = 5.25$, $P < .001$). After 15 minutes the pressures returned to approximately the pre-exercise values. After marathon running of 26 minutes, there was an average drop of 2.27 mmHg among 63 runners. This was also significant. Subjects with higher initial pressures also tended to have greater pressure reductions after running. The conclusion was that aerobic exercise produces a definite decrease in IOP.

Krelar and Teraslinna[13] examined the effects of standardized aerobic and anaerobic exercise intensity levels on IOP. IOP decreased rapidly at all exercise levels. Exercise was done on a bicycle, and a Schiotz tonometer was used to take measurements. The drop of IOP with exercise was proportional to the work load but not statistically significant. The lowest IOP reached at all intensities varied only 1.5 mmHg. This indicated that factors responsible for decreasing IOP affect mechanisms which have a specific limit to which they can lower IOP.

The same investigators just mentioned did a similar study a year later,[14] in which seven males, ages 23-45 were tested while doing bicycle ergometry to determine the effects of different intensities of exercise on IOP. Measurements were taken at rest, at the midpoint of exercise, at the end, and during the first ten minutes of recovery. The intensity of exercise was found <u>not</u> to be related to the amount of decrease in IOP. The decrease in IOP was associated again with a decrease in blood pH and an increase in blood lactate concentration.

decreases in IOP were significant in the control group also. Although the observed reduction in biweekly IOP measurements was significant in the exercise group alone, results of t-tests showed that the difference between the experimental and control groups was not significant. Since exercise and physical fitness did not significantly lower IOP, it was suggested by the authors that future research should also focus on stress and anxiety reduction as a means of influencing IOP.

Although no published studies exist specifically dealing with stress reduction and IOP, a few books mention a possible relationship. If the assumption based on studies previously discussed is accepted that blood pressure and IOP are related in some direct relationship, then the hypothesis that stress and emotion can affect IOP may be proposed. The fact that stress plays a part in influencing blood pressure is a well known medical fact, made even more pointed by the clinical definition of stress by the National Conference on Emotional Stress and Heart Disease:[17] stress is an obviously painful or adverse force which induces distress or strain upon both the emotional and physical makeup. When mentioning stress in this study, we will be referring to this definition. Hans Selye, the well known psychologist, mentions many studies which name stress as a major factor causing many of the symptoms seen in hypertensive individuals.[18] These studies involved injecting DOC (desoxycorticosterone), a hormone produced in excess by the adrenal gland during periods of stress, into various animals. In all animals this hormone produced, in addition to other cardiovascular disorders, high blood pressure.[18] Selye states that an actual increase in DOC-like material has been demonstrated with certainty in humans suffering from cardiovascular disease.[18] Eliot's paper states that increased job stress

can raise cholesterol levels as much as 100 mg% in a short time.[17] A high cholesterol level is a sign heralding high blood pressure. Finally, beta blocking drugs which block the sympathetic nervous system, the system excited in times of stress, will treat hypertension successfully.[17]

Chandler[19] writes about emotions and IOP. An attack of acute angle-closure glaucoma may be precipitated by strong emotion due to the pupil dilation and congestion of the intraocular vessels. But attempts to alleviate open-angle glaucoma by means of sedatives and tranquilizers have been unsuccessful, thereby disclaiming any correlation between stress and IOP.[19] However, a paper by Leydhecker[20] states that in glaucomatous eyes with a wide angle, tranquilizers or ethyl alcohol can decrease the IOP considerably. The subject is open and controversial at best.

METHODS AND MATERIALS

Subjects were taken from two groups. One group of subjects were those taking an aerobic dance class that met at the Forest Grove branch of Portland Community College. The subjects were thirteen women ranging in age from 21 - 53. Only subjects who had either not done aerobic dancing in the last six months or had never done it could participate in the study. The class met twice a week at night and lasted approximately one hour each session. It consisted of stretching for 5-10 minutes, dancing 30 minutes, walking for one minute, dancing another 20 minutes, and learning new dance steps in the last 10 minutes. Measurements were taken at only one of the sessions each week. The class lasted for five weeks.

The second group of subjects was enrolled in a stress management class that met once a week for two hours. The subjects were four males and one female, ranging in age from 22 - 62. The class consisted

of various exercises, physical and mental, designed to relieve stress. These included rhythmic deep breathing, muscular tensing and relaxing, mental imagery, and biofeedback. The same measurements that were taken on group one were also taken on group two, over a five week period, in the same manner as will now be described.

Three IOP measurements were taken on each eye, beginning with the right, immediately before class and between 1-8 minutes after the end of each class. The AO non-contact tonometer (AONCT) was employed. The AONCT was used for several reasons: it was the instrument used in three of the studies cited in the literature review;[12,15,16] its advantages include its being entirely objective, requiring no contact with the cornea and therefore no anesthetic, and eliciting little patient anxiety or discomfort that may otherwise artificially raise a subject's IOP.[21] The NCT is highly repeatable to within 1.0 mmHg.[21] Although a lowering of .56 mm often occurs on the second successive reading,[22] this effect is minimized by averaging three successive readings,[21] which was done in this study. In addition, a contact-tonometer as opposed to an NCT, tends to distort results by altering the steady state conditioning of the eye during repeated IOP readings.[16]

Systolic and diastolic blood pressure was measured immediately prior to and following exercise within eight minutes, with a mercury sphingomamometer and blood pressure cuff, using the auscultatory technique (over the brachial artery). The mercury sphingomamometer was the instrument of choice used in measuring blood pressure in the literature previously cited.[6-15]

All subjects filled out a survey and release form, which may be found in Appendices A and B.

RESULTS

A two-factor analysis of variance was done on the data collected. The two factors were:

(1) the before and after effect of either aerobic dance or relaxation therapy exercises on either IOP or blood pressure

(2) the time factor, i.e., the five weeks over which the subjects were measured.

A significance criteria of $p < .05$ was established as a criterion.

Results indicated that neither relaxation therapy nor aerobic dance exercises had any lowering effect on either IOP or blood pressure under the conditions that existed in this study.

Tables 1 and 2 show mean scores representing the average measurement of all participating subjects in the particular class indicated. In the case of the IOP measurement, the figure is the mean reading of between 4-6 readings combined from both left and right eyes. Three IOP readings were taken on each eye, except where two successive readings on one eye were equal, in which case only two measurements were obtained. Readings from left and right eyes on each subject were combined for statistical purposes, since no significant difference between right and left eyes was found in any of the subjects.

The principal variables needed for computation using two factor analysis of variance are shown in Tables 3 and 4. Source A is the factor representing before and after effects of either exercise or relaxation therapy. Source B represents the time factor added for each week the study progressed. AB is any effect(s) resulting from interaction between the two other factors. The within figures represent population variance within a group of subjects. The F numbers are referenced in a table in order to determine significance at the $p < .05$ level.

TABLE 1

Summary of the Mean IOP, Systolic Blood Pressure, and Diastolic Blood Pressure Values for Thirteen Subjects in the Aerobic Dance Class.

IOP Week:	1	2	3	4	5	$\bar{x}$
Means before class	13.38	12.58	12.38	11.79	12.18	12.46
Means after class	12.68	11.87	12.39	11.93	11.78	12.13
Means of before & after	13.03	12.23	12.39	11.86	11.98	12.30

Systolic Blood Pressure Week:	1	2	3	4	5	$\bar{x}$
Means before class	124.00	116.46	117.00	117.85	117.85	118.63
Means after class	121.38	115.08	113.23	111.31	115.69	115.34
Means of before & after	122.69	115.77	115.12	114.58	116.77	116.99

Diastolic Blood Pressure Week:	1	2	3	4	5	$\bar{x}$
Means before class	76.77	66.31	70.00	68.62	66.31	69.60
Means after class	72.00	69.38	65.39	64.31	65.23	67.26
Means of before & after	74.39	67.85	67.70	66.47	65.77	68.43

TABLE 2

Summary of the Mean IOP, Systolic Blood Pressure, and Diastolic Blood Pressure Values for Five Subjects in the Relaxation Therapy Class

IOP Week:	1	2	3	4	5	$\bar{\bar{x}}$
Means before class	12.80	12.00	11.71	12.10	11.37	12.00
Means after class	11.50	11.95	11.87	11.40	11.80	11.70
Means of before & after	12.15	11.98	11.79	11.75	11.59	11.85

Systolic Blood Pressure Week:	1	2	3	4	5	$\bar{x}$
Means before class	130.00	129.20	136.00	129.20	127.20	130.32
Means after class	120.80	137.40	132.00	128.40	128.40	129.40
Means of before & after	125.40	133.30	134.00	128.80	127.80	129.86

Diastolic Blood Pressure Week:	1	2	3	4	5	$\bar{x}$
Means before class	80.40	77.20	80.00	82.80	76.80	79.44
Means after class	78.80	81.60	77.20	82.40	80.00	80.00
Means of before & after	79.60	79.40	78.60	82.60	78.40	79.72

TABLE 4

Summary of IOP, Systolic Blood Pressure, and Diastolic Blood Pressure Statistical Significance Values for the Relaxation Therapy Class

IOP				
Source	df	SS	$MS = \frac{SS}{df}$	$F = \frac{MS}{MS \text{ within}}$
A	1	1.13	1.13	.56
B	4	1.88	0.47	.23
AB	4	4.92	1.23	.61
within	40	80.98	2.02	-

Systolic Blood Pressure				
Source	df	SS	$MS = \frac{SS}{df}$	$F = \frac{MS}{MS \text{ within}}$
A	1	10.58	10.58	.02
B	4	542.32	135.58	.24
AB	4	414.32	103.58	.18
within	40	22,400.06	560.00	-

Diastolic Blood Pressure				
Source	df	SS	$MS = \frac{SS}{df}$	$F = \frac{MS}{MS \text{ within}}$
A	1	3.92	3.92	.03
B	4	114.08	28.52	.25
AB	4	96.48	24.12	.21
within	40	4584.98	114.62	-

analytical long run. Therefore, random error contributed to an inability to reject the null hypothesis. Initially, there were more subjects participating in the study than the number used in the end for data collection. However, in a study where subjects cannot be paid, uncontrollable circumstances do occur, such as subject drop-out, irregular subject attendance at class sessions, and a lack of subject control.

REFERENCES

1. Reese, A.B. and J.S. McGavic, Relations of field contraction to blood pressure in chronic primary glaucoma, Archives of Ophthalmology, 27(5): 845-850, 1942.

2. Daubs, Jack, A retrospective analysis of the systolic BP/IOP ratio in glaucoma screening, Journal of the American Optometric Association, 47(4): 450-455, 1976.

3. Leighton, D.A. and C.I. Phillips, Systolic blood pressure in open-angle glaucoma, low tension glaucoma, and the normal eye, British Journal of Ophthalmology, 56: 447-453, 1970.

4. Cullen, A.P., H.R. Sharp, S.V. Moore, D.E. McCoy, Systolic blood pressure as a diagnostic tool in glaucoma, American Journal of Optometry and Physiological Optics, 51(6): 414-417, 1974.

5. Bulpitt, C.J., C. Hodes, M.G. Everitt, IOP and systolic blood pressure in the elderly, British Journal of Ophthalmology, 59: 717-720, 1975.

6. Lempert, P., K.H. Cooper, J.F. Culver, T.J. Tredici, The effect of exercise on IOP, American Journal of Ophthalmology, 63(6): 1673-1676, 1967.

7. Stewart, R.H., R. LeBlanc, B. Becker, Effects of exercise on aqueous dynamics, American Journal of Ophthalmology, 69(2): 245-248, 1970.

8. Marcus, D.F., T. Krupin, S.M. Podos, B. Becker, The effect of exercise on IOP: Human beings, Investigative Ophthalmology, 9(10): 749-752, 1970.

9. _____, The effect of exercise on IOP: Rabbits, Investigative Ophthalmology, 9(10): 753-757, 1970.

10. Leighton, D.A., C.I. Phillips, Effects of moderate exercise on the ocular tension, British Journal of Ophthalmology, 54: 599-605, 1970.

11. Leighton, D.A., Effects of walking on the ocular tension in open-angle glaucoma, British Journal of Ophthalmology, 56: 726-730, 1972.

12. Myers, K.J., The effect of aerobic exercise on IOP, Investigative Ophthalmology, 13(1): 74-76, 1974.

13. Krelar, R.A., P. Teraslinna, D.G. Rowe, J. Jackson, Standardized aerobic and anaerobic exercise: differential effects on intraocular tension, blood pH, and lactate, Investigative Ophthalmology, 14(10): 782-785, 1975.

14. Rowe, D.G., P. Teraslinna, R.A. Krelar, J.A. Jackson, Effects of different intensities of exercise on intraocular pressure, Research Quarterly, 47(3): 436-443, 1976.

15. Krejci, R.C., R.B. Gordon, C.T. Moran, R.G. Sargent, J.C. Magun, Changes in IOP during acute exercise, American Journal of Optometry and Physiological Optics, 58(2): 144-148, 1981.

16. Sargent, R.G., S.N. Blair, J.C. Magun, R.C. Krejci, C. Sacoco, T.D. Langley, R.L. Taylor, Physical fitness and intraocular pressure, American Journal of Optometry and Physiological Optics, 58(6): 460-466, 1981.

17. Eliot, R.S., Stress and cardiovascular disease, European Journal of Cardiology, 5(2): 97-104, 1977.

18. Selye, Hans, The Stress of Life, New York, McGraw Hill & Co., 1956, pp. 54, 131, 135, 136, 142, 144.

19. Chandler, Paul, and W.M. Grant, Glaucoma, Philadelphia, Lea & Febiger, 1979, pp. 7-8.

20. Leydhecker, W., The IOP: clinical aspects, Annals of Ophthalmology, 8: 389-399, 1976.

21. Wiley, T., Non-contact tonometry, Optometric Weekly, 67(26): 37-39, 1976.

22. Myers, K.J., Repeatability of IOP measurements with the non-contact tonometer, American Journal of Optometry and Physiological Optics, 51(39): 39-48, 1974.

23. McCall, Robert, Fundamental Statistics for Psychology, New York, Harcourt Brace Jovanovich, Inc., 1980, pp. 287-309.

APPENDIX A

PACIFIC UNIVERSITY
COLLEGE OF OPTOMETRY

The Effects of Aerobic Dancing and
Relaxation Therapy on Intraocular Pressure and Blood Pressure

We are third year optometry students doing this survey as a part of our senior thesis project. Our project is designed to study the effects of aerobic dancing and relaxation therapy on intraocular pressure (eye pressure) and blood pressure. Measurements will be taken with the American Optical non-contact air puff tonometer. A standard blood pressure cuff using the auscultatory method will be used for taking blood pressure measurements. Hopefully the results of this study will tell whether or not relaxation therapy and/or aerobic dancing can be used as activities to significantly lower intraocular pressure and blood pressure.

A copy of this research survey and project will be available at Pacific University College of Optometry. Thank you for your cooperation.

Avrel Nudelman
Avrel Nudelman
Third Year Student

Kathy Kopecko
Kathy Kopecko
Third Year Student

Norman Stern, O.D., Ph.D.
Advisor

Instructions:
Please answer the following questions by circling the appropriate response, writing out the answer, or filling in the blank. Use the back of the page if necessary.

Name: _____ Age: _____ Sex: _____

Address: _____

Phone: _____ Date: _____

2043 COLLEGE WAY FOREST GROVE, OREGON 97116 TELEPHONE (503) 357-6151

1. Do you exercise and/or engage in any type of relaxation therapy (including meditation, yoga, etc.) regularly? Yes No

   a. If yes, describe the activity(ies):

   b. For how long have you been engaging in this activity(ies)?

   c. How many times a week and for approximately how long do you engage in this activity(ies):

   d. Have you engaged in any of these activities today? Yes No

      If yes, name the activity(ies):

      For how many minutes did you engage in this activity(ies)?

*2. Please try to list as best you can, all you have eaten in the last 24 hours under the appropriate columns:

Breakfast	Lunch	Dinner	Snacks

*3. Approximately how much fluid have you ingested in the last six hours? (How many glasses?):

4. Approximately how much salt is there in your diet? (circle one)
   Small amount (1-2 shakes or less per meal)

   Moderate amount (3-4 shakes per meal)

   Large amount (greater than 4 shakes per meal)

5. What is your primary occupation?

   a. Name any secondary occupations:

6. Stress: Stress is defined for the purposes of this study as any mental (psychological) or physical tension.

   a. Does your occupation involve: Mental tension? Yes No

      Physical tension? Yes No

   b. Does your occupation involve very much close and detailed work within arms length? Yes No

      If yes, how much near work (quantify in hours/day)?

   c. Does your daily lifestyle involve: Mental tension? Yes No

      Physical tension? Yes No

* to be answered at each session

6. (Cont.)

d. Does your daily lifestyle involve very much close and detailed work within arms length? Yes No

If yes, how much near work (quantify in hours)?

e. Strictly subjectively speaking, how much stress would you say is part of your day to day life?

Small amount Moderate amount Large amount

7. Health

a. You would describe your general state of health as:

Poor Fine Excellent

*b. List any prescription or non-prescription medications and/or drugs you are currently taking:

Drug and/or Medication	No. of Times Taken Per Week	Day and Time Last Taken

c. Do you have glaucoma? Yes No

If yes, are you taking medication and/or treatment for this? Yes No

If yes, describe the medication and/or treatment:

d. Do you have high blood pressure? Yes No

If yes, are you taking medication and/or treatment for this? Yes No

If yes, describe the medication and/or treatment:

e. Do you have any family history of glaucoma? Yes No

of high blood pressure? Yes No

* to be answered at each session

Examiner's Space:

Subject's Name _____ Activity _____

Week	Date	IOP Before OD	IOP Before OS	IOP After OD	IOP After OS	Bl. Pressure Before	Bl. Pressure After
1							
2							
3							
4							
5							
6							
7							
8							

APPENDIX B

HUMAN SUBJECT RELEASE FORM

Project Title: The Effects of Aerobic Dancing and Relaxation Therapy on Intraocular Pressure and Blood Pressure

Investigators: Avrel Nudelman, Kathy Kopecko
Advisor: Norman Stern, O.D., Ph.D.
Location: Pacific University College of Optometry
Date: March 1981

1. Description of Project
   This project is designed to study the effects of aerobic dancing and relaxation therapy on intraocular pressure (eye pressure) and blood pressure. Measurements will be taken with the American Optical non-contact air puff tonometer. Blood pressure measurements will be taken with the standard blood pressure cuff using the auscultatory technique.

2. Description of Risks
   The only risks involved are those normally encountered in a health care environment.

3. Description of Benefits
   If the activities under investigation do indeed significantly lower eye pressure, they could be used as a supplemental therapy for open angle glaucoma.

4. Benefits to Subjects
   By participating in this study you will receive an intraocular pressure reading and blood pressure reading at no cost.

5. Compensation and Medical Care
   If you are injured in this experiment it is possible that you will not receive compensation or medical care from Pacific University, the experimenters, or any organization associated with the experiment. All reasonable care will be used to prevent injury however.

6. Offer to Answer Any Inquiries
   The experimenters will be happy to answer any questions that you may have at any time during the course of this study.

7. Freedom to Withdraw
   You are free to withdraw your consent and to discontinue participation in this project or activity at any time without prejudice to you.

I have read and understand the above. I am 18 years of age or over.

Signed _____ Date _____

Address _____

Phone _____

Name and address of a person not living with you who will always know your address _____

_____