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A New Look at Myopia Development:

Possible Links With Childhood Stress and Diet

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ABSTRACT

Approximately 60% of young people in the U.S. are myopic (nearsighted), yet no clear etiology has been identified. Psychological factors that could be related to myopia development have received virtually no research attention, and dietary factors have received little attention. In this exploratory study, undergraduates ($N = 417$) completed questionnaires about their childhood perceptions and experiences related to multiple factors, including perceived psychological stress, diet, near work, and time spent outdoors. Myopic participants reported significantly less childhood stress than did emmetropic (normal vision) participants, raising the possibility of differential processing of stressful events by myopes and emmetropes. Myopic participants reported significantly less fresh fruits, vegetables, and whole grains in their childhood diet; less often playing outdoors; less light on the page when reading; more hours watching television; and more myopic relatives. No significant differences were found in reported time spent in reading and computer use. Stress and diet were found to be independent factors approximately equal in effect; their effects appeared additive. Results point to new fruitful areas for investigation into mind-body connections and modifiable risk factors in development.

Keywords: myopia, vision, children, stress, diet

A New Look at Myopia Development: Possible Links With Childhood Stress and Diet

Myopia, commonly called nearsightedness, is a vision problem that usually develops in childhood and generally persists throughout life. Approximately 60% of young adults in the U.S. ages 23 to 34 are estimated to be myopic (Framingham Offspring Eye Study Group, 1996), with higher rates currently reported in some other countries (Morgan & Rose, 2005). People with myopia cannot see distant objects clearly, and its presence is often first discovered when children cannot read the blackboard in school. Myopia may have substantial social, educational, economic, and personal consequences (Orfield, 2007; Saw, Katz, Schein, Chew, & Chan, 1996), and severe myopia may be associated with many serious eye conditions (Saw et al.).

Traditional medical theories have concentrated on inheritance and near work as causes. For almost 400 years, near work in childhood has been considered an important cause of myopia; however, recent studies have found that near work is not a risk factor for myopia (Mutti & Zadnik, 2009). Mind-body interactions continue to be overlooked, as do other important developmental factors such as diet. Psychological factors that could be related to myopia development have to date received anecdotal mention (Dobson, 1949; Liberman, 1995) but virtually no research attention. It is well established that psychological conflicts or other stressors can sometimes produce temporary blindness (American Psychiatric Association, 2000); therefore, it is possible that mental and emotional states may influence vision. Although the role of diet has been associated with certain vision problems such as night blindness, macular degeneration, cataract, and amblyopia (Congdon & West, 1999), its potential contributory role in myopia has not been explored. With the great and frequently rapid changes in myopia incidence in certain populations (Morgan, Speakman, & Grimshaw, 1975; Taylor, Robin, Lansingh, Weih, & Keeffe, 2003; Young et al., 1969), and with myopia rates increasing internationally (Dayan et

al., 2005; Morgan & Rose, 2005), it now seems likely that environmental factors are involved (Forrest, 1988; Goldschmidt, 2003). Based on a biopsychosocial developmental approach, this exploratory study's goal was to find preliminary evidence of modifiable risk factors for the development of myopia.

The review by Cordain, Eaton, Miller, Lindeberg, & Jensen (2002) of studies of myopia in primitive, urban, and rural groups, concludes that environmental factors may play a role in myopia etiology. Morgan and Rose (2005) give comprehensive evidence for an environmental component based on urbanization. In fact, urbanization would be expected to create a multiplicity of changes in children's lifestyles, including diet (e.g., foods that are not as fresh due to access to refrigeration, non-locally grown food, processed, canned, and frozen food); posture (e.g., sitting in chairs instead of on the ground, sitting in motor vehicles, less physical activity); more schooling and less time outdoors; exposure to artificial light; more noise; more pollution, etc. Based on the literature, there is reason to believe that environmental factors including diet (Cordain et al.; Edwards, Leung, & Lee, 1996; Kerr & Tappin, 2002; Lane, 1982); stress (Yoo, Logani, Mahat, Wheeler, & Lee, 1999); and time spent outdoors (Clements, 2004; Rose, Morgan, Ip, et al., 2008; Rose, Morgan, Smith, et al., 2008; Spitler, 1941), all may play a part in myopia etiology. Dietary factors that have been mentioned as possibly linked with myopia include refined carbohydrates (Cordain et al.); fatty acids (Jeffrey, Weisinger, Neuringer, & Mitchell, 2001; Makrides, Neumann, Simmer, Pater, & Gibson, 1995); protein (Bardiger & Stock, 1972; Gardiner & Lond, 1958); calcium (Walker, 1932); vitamin D (Knapp, 1939); carrots (Johnson, Saunders, & Mull, 1944); and breastfeeding (Chong et al., 2005). We were not able to find research that examined the relation between myopia and the relative presence of fresh fruits and vegetables in the diet.

We hypothesized that, compared with emmetropes, myopes would report experiencing more childhood stress, and less fresh fruits and vegetables and whole grains and more processed and "junk" foods in their childhood diet. In order to test the commonly held beliefs about the causation of juvenile-onset myopia, we hypothesized that (a) there would be a strong relation between the reported vision status of the participants and their biological family members, and (b) myopic participants would report more reading, more computer use, more television viewing, less outside play, more reading in dim light, and more reading not at a desk during childhood.

Method

Participants and Design

Participants were undergraduate students enrolled in the first author's psychology classes in Fall 2006, Spring 2007, and Fall 2007 semesters. A total of 417 freshmen and sophomore students in 15 classes participated. Recruitment and participation were in the classroom. Participants received verbal explanations of "normal vision," nearsightedness, and farsightedness, and the difference between hyperopia (farsightedness) in youth and presbyopia (limited lens accommodation from age). They then self-assigned to one of the three comparison groups: emmetropia, myopia, and hyperopia (in youth). Only data comparing myopes and emmetropes were used in the subsequent analyses. Questionnaires of participants unsure of their vision status were excluded. The number of participants in each comparison group was: myopia, 197 (47%); emmetropia, 175 (42%); hyperopia (farsighted, not presbyopic), 24 (6%). There were 21 undecided participants (5%). Participants were 71% female (n = 296) and 29% male (n = 121), and predominantly White (91%) and of working class background. The percentage of participants by age was: age 19 or younger, 49%; age 20-24, 29%; age 25-29, 7%; age 30-39, 10%; age 40 or older, 5%.

Instruments and Procedure

Participants completed an anonymous questionnaire about their childhood perceptions and experiences between ages 6 and 13 related to multiple factors mentioned in the literature as possibly linked to myopia development. The questionnaire was constructed for purposes of this study and was pilot tested on two classes. Most questions were answered by marking a Likert scale with 2 to 5 choices. Almost every question had a choice of "not sure," "don't know," or "don't remember." Instructions asked participants to answer to the best of their memory, but if not reasonably sure of an answer, to enter the answer "not sure." They were specifically told not to guess, and that they could omit answering any question. Responses were indicated on an optical scanning form. Participants who had undergone refractive surgery were told to answer based on their pre-surgical vision. Later in the semester, each class received information about the cumulative results of the study up to that point in time in an in-class debriefing. Questions included demographic and biographical questions, including vision-related questions used to verify the self-assignment into comparison groups; participants whose answers raised questions about the accuracy of their self-assignment were assigned to the undecided group. Childhood stress was evaluated with questions that asked if there were events that triggered feelings that were very difficult to deal with at that time; a major change or major loss; psychological or emotional trauma; physical or sexual trauma; emotional pain; fear or anxiety related to physical safety; high levels of stress; stress over a long period of time; experience of fear, anger, loneliness, or another strong emotion; and highest level of stress experienced between ages 6 to 13, and ages 14 to 18. Quantity of fresh fruits and vegetables and whole grains in the childhood diet was assessed with questions that asked the frequency of eating carrots, sweet potatoes, cantaloupes; blue or black fruits; whole wheat bread, or other products made

from whole wheat; brown rice; other whole (unrefined) grains; fresh (not canned or frozen) fruits and vegetables; raw (uncooked) fruits and vegetables; and oranges, orange juice. Quantity of processed and "junk" foods in the childhood diet was evaluated with questions that asked the frequency of eating sugar or foods containing sugar, fried foods, "fast food," canned foods (including home canned), frozen foods, and soft drinks. Other questions included how often the participant played outdoors; number of hours spent outside; light when reading; and time spent reading, watching television, and using a computer, including the intensity with which these were engaged in.

Analytic plan

Three hypothesis-driven index scores were calculated: (a) psychological stress (15 items), (b) consumption of processed food (6 items), and (c) consumption of fresh food (8 items). Cronbach alphas ($\alpha = 0.81$, 0.81, and 0.76, respectively) suggested that the scales had adequate internal consistency reliability. Comparisons of myopes and emmetropes were done with *t*-tests on the scales and selected sets of items, and with a logistic regression on two scales at once. We used a bootstrap correction for multiple testing based on the false discovery rate (Benjamini & Hochberg, 1995; Hochberg, 1988) and software (Westfall, Tobias, Rom, Wolfinger, & Hochberg, 1999). Effect sizes (ESs) will be Cohen's $d = (M_1 - M_2) / SD_{pooled}$ (Cohen, 1988), the difference between groups expressed in standard deviations. According to Cohen, small/medium/large values are .2/.5/.8 SDs. To evaluate effect size in the logistic regression, we used the area under the receiver-operator characteristic (ROC) curve.

Results

Psychometric results

Three indices were calculated to test the three hypotheses. Each total score is the mean of the Likert scale item scores. Descriptive statistics appear in Table 1.

Demographics and vision

Examination of demographics suggested that more women were myopic (57% of the women, 43% of the men, ($\chi^2(df = 1) = 5.99$, $p = .01$). Contingency tables with χ^2 tests found no relationship between having normal vision and race ($p = .79$) or age ($p = .90$).

Tests of main hypotheses

We hypothesized that myopes would report more childhood stress, more processed and junk food, and less fresh food in their childhood diet.

Results of the 3 pre-stated hypotheses tested with index scores in bootstrap *t*-tests follow:

1. Contrary to prediction, myopes reported significantly *less* stress ($p = .008$, ES = 0.31).
2. There was no difference for processed food ($p = .743$, ES = -0.09).
3. As predicted, myopes reported less consumption of fresh food ($p = .016$, ES = 0.29).

The two significant differences have small-to-medium effect sizes, $d \approx 0.3$. These results appear in Table 2, top panel.

The correlation between the stress and fresh food indices was negligible, *r*(Stress, Fresh food) = -.01 ($p = .82$). To see if the significant effects of stress and diet were additive, they were put together into a logistic regression based on the model ***Myopia (0, 1) = F(Stress, Fresh food)***. The two standardized betas were almost exactly equal (0.18, 0.17), and both had pseudo-R^2 of 3%, suggesting separate approximately equal additive effects. The area under the ROC curve was only 0.625, suggesting a degree of prediction too low for clinical use with individuals. When

the two predictors were allowed stepwise entry into the logistic regression, stress entered first (Nagelkerke rescaled R^2 = 3%) followed by vegetables (R^2 = 6%), again suggesting separate additive effects.

Because of the higher rate of myopia among women, we added gender and its interactions with stress and diet to the logistic model. The main effect of gender was significant, of course, but gender * stress was not (p = .78), nor was gender * fresh food (p = .09). This result finds no difference between men and women in how stress and diet relate to myopia.

Secondary Hypotheses

Of the 17 "common wisdom" hypotheses, the 7 significant results appear in Table 2, lower panel. Items included possible higher myopia incidence among biological relatives (4 items: biological father and mother, oldest male and female sibling); amount of outdoor activity (4 items); near work (6 items: computers, TV, reading); lighting (2 items); and posture (1 item). Effect sizes for the significant differences were medium to large. Myopes recalled significantly less light on the page when reading (ES = 0.33), more TV time (ES = -0.38), and less often playing outdoors (ES = 0.33). In addition, there were 4 significant indicators of myopia in the immediate family (ES ranging from -0.43 to -0.71), suggesting that myopes had more myopic relatives than did emmetropes. We decided our posture results were inconclusive due to the inability of most people to evaluate their own posture.

Discussion

This retrospective survey found significant differences between myopes and emmetropes. Significant differences appeared even after bootstrap correction for multiple testing.

1. Women were more likely than men to be myopic.

2. Myopes reported: (a) experiencing less stress in childhood (reversing prediction), (b) no difference in eating processed foods (failed prediction), and (c) eating fresh food less often (as predicted).

3. Exploratory analyses suggested that myopes have more close relatives with myopia, played outdoors less often, had less light on the page when reading, and watched more television.

Contrary to our prediction, emmetropes reported more stress and stress-related emotions between ages 6 and 13 than did myopes, raising the possibility of differential processing of stressful events by children who are emmetropic and myopic. These findings are counterintuitive and, we believe, previously unreported. If confirmed, they provide evidence for a psychological correlate of myopia in children, namely that myopic children perceive their childhoods as less stressful. It is possible that emmetropes have actually experienced more childhood stress, and that childhood stress correlates with better vision. However, it is also possible that, parallel to perceptual problems with vision, children who develop myopia have perceptual problems related to recognition and interpretation of stressful situations in their lives. It is also conceivable that emmetropes have better memories, are more easily stressed, or are more psychologically "vigilant" than myopes. Any of these explanations may indicate a systematic psychological difference between myopes and emmetropes. Anecdotally, some participants in the survey reported, in personal communications to the first author, traumatic events that preceded, within a few weeks, their retrospective report of myopia onset.

Compared to myopes, emmetropes reported eating fresh food more often. Fresh food is a previously unexplored area in myopia etiology and potentially a critical etiological factor. Level of fresh food consumption is consistent with many seemingly disparate reports of myopia prevalence and with correlations noted in the literature between urbanization and myopia.

Further, our data suggest separate and additive effects for stress and fresh food, which were uncorrelated with each other, raising the possibility that there are other unknown independent and additive differences between myopes and emmetropes. In that case, myopia might be the result of many incremental differences in the details of life that differ between aboriginal and modern times. Since there was no significant difference in consumption of processed and "junk" food reported by myopes and emmetropes, it can be speculated that fresh food may exert a protective influence that overcomes any negative dietary influence of processed food in myopia development.

Compared to myopes, emmetropes reported playing outdoors more often. This is consistent with recent studies that have found juvenile-onset myopia associated with less time spent in outdoor activities (Rose, Morgan, Ip, et al., 2008; Rose, Morgan, Smith, et al., 2008). American children today play outdoors less than their parents did (Clements, 2004), and urbanization would be expected to reduce the time children spend outdoors. Consistent with the literature, myopic participants reported more myopic biological relatives than did emmetropic participants. Such correlations could be related to heredity or environment, e.g., eating a similar diet, or both. Gender comparisons found a higher rate of myopia among female participants. This would be consistent with possible dietary, outside play, and stress-related differences between genders, and with girls being taught to deal with stressors differently. However, despite the main effect of gender, the logistic regression found no gender interaction moderating the effects of stress or diet. Based on our data, the effects of stress and diet are about the same for males and females. Beginning at age 9 there may be a gender-specific response to trauma, with boys externalizing more than girls and girls internalizing more than boys (Dulmus & Hilarski, 2006), which may have relevance if myopia development relates to psychological stress. As feeling

unhappy about having to wear glasses was correlated with reported personality change after starting to wear glasses ($r = 0.24$), for some children myopia may have important effects on personality development.

If correlations between psychological and environmental factors and the development of myopia are confirmed by future studies, the mechanisms by which these might act can then be explored. For example, it is believed that chronic blur may induce myopia (Gwiazda et al. 1993). It is possible that dietary deficiencies or psychological factors could be the cause of blur that may then induce myopia. Consistent with recent studies (Mutti & Zadnik, 2009), amount of reading did not show significance in our data. It is possible that posture while reading (Harmon, 1958; Zylbermann, Landau, & Berson, 1993) or dim or artificial light while reading could be a risk factor for myopia rather than reading itself.

One limitation of this study is the use of retrospective self-report. Another limitation is having undergraduate participants from one institution, limiting generalizability. Also, myopes and emmetropes may have consistent differences in memory, perception, or interpretation that have affected our results. If systematic differences exist, they may provide researchable clues. Another limitation is the lack of precision of some of the diet questions compared with a formal food diary. Characteristics that distinguish myopes from emmetropes may be etiological, may be the result of the myopia, or may, along with the myopia, be caused by a third factor.

Suggestions for future studies include prospective longitudinal studies that evaluate children's psychological approach to stress, and whether there are changes in perception or processing of stress, or in number and intensity of stressful events, around the time a child develops myopia. A study of child-parent dyads could compare myopic children at the time of first myopia diagnosis with non-myopic children matched for gender, age, and grade, on diet and

other factors. Whether children in the earliest stages of myopia show improved vision if exposed to factors found to be associated with non-myopic children could be studied. Also, in-depth interviews of myopic and emmetropic adults related to psychological issues during their childhood could yield insights (Azar, 1999).

With the growing prevalence of myopia, studies are needed that take a fundamentally new approach. Goldschmidt (2003) states, "The aetiology of myopia is like a puzzle in which some of the most important pieces are missing." Developmental psychology brings to the study of myopia development a multidisciplinary outlook and an understanding and appreciation of mind-body interactions, and may enable us to find the missing pieces. Although our exploratory study has limitations, its findings are consistent with the newest research on the relation of reading and outdoor activity with myopia development. We believe our data on the relation of psychological stress and diet with myopia development are provocative and merit the attention of researchers interested in the interactions of the body and the mind in human development.

References

American Psychiatric Association. (2000). *Diagnostic and statistical manual of mental disorders* (4th ed., Text rev.). Washington, DC: Author.

Azar, B. (1999). Consortium of editors pushes shift in child research method [Electronic version]. *APA Monitor Online, 30*(2). Retrieved October 17, 2008, from http://www.apa.org/monitor/feb99/qual.html

Bardiger, M., & Stock, A. L. (1972). The effects of sucrose-containing diets low in protein on ocular refraction in the rat. *Proceedings of the Nutrition Society, 31*(1), 4A-5A.

Benjamini, Y., & Hochberg, Y. (1995). Controlling the false discovery rate: A practical and powerful approach to multiple testing. *Journal of the Royal Statistical Society, B, 57*, 289-300.

Chong, Y. S., Liang, Y., Tan, D., Gazzard, G., Stone, R. A., & Saw, S. M. (2005). Association between breastfeeding and likelihood of myopia in children. *JAMA, 293*(24), 3001-3002.

Clements, R. (2004). An investigation of the status of outdoor play. *Contemporary Issues in Early Childhood, 5*(1), 68-80. Retrieved October 17, 2008, from http://www.wwwords.co.uk/ciec/content/pdfs/5/issue5_1.asp

Cohen, J. (1988). *Statistical Power Analysis for the Behavioral Sciences* (2nd ed.). Hillsdale, NJ: Erlbaum.

Congdon, N. G., & West, K. P. (1999). Nutrition and the eye. *Current opinion in ophthalmology, 10*, 464-473.

Cordain, L., Eaton, S. B., Miller, J. B., Lindeberg, S., & Jensen, C. (2002). An evolutionary analysis of the aetiology and pathogenesis of juvenile-onset myopia. *Acta Ophthalmologica Scandinavica, 80,* 125-135.

Dayan, Y. B., Levin, A., Morad, Y., Grotto, I., Ben-David, R., Goldberg, A., et al. (2005). The changing prevalence of myopia in young adults: A 13-year series of population-based prevalence surveys. *Investigative Ophthalmology & Visual Science, 46*(8), 2760-2765.

Dobson, J. P. (1949). Emotional background of myopia. *Journal of Aviation Medicine, 20*(5), 365-370.

Dulmus, C. N., & Hilarski, C. (2006). Significance of gender and age in African American children's response to parental victimization. *Health & Social Work, 31*(3), 181-188.

Edwards, M. H., Leung, S. S. F., & Lee, W. T. K. (1996). Do variations in normal nutrition play a role in the development of myopia? *Optometry and Vision Science, 73*(10), 638-643.

Forrest, E. B. (1988). *Stress and vision*. Santa Ana, CA: Optometric Extension Program Foundation.

Framingham Offspring Eye Study Group. (1996). Familial aggregation and prevalence of myopia in the Framingham Offspring Eye Study. *Archives of Ophthalmology, 114,* 326-332.

Gardiner, P. A., & Lond, M. B. (1958). Dietary treatment of myopia in children. *Lancet, 271*(7031), 1152-1155.

Goldschmidt, E. (2003). The mystery of myopia. *Acta Ophthalmologica Scandinavica, 81*(5), 431-436.

Gwiazda, J., Thorn, F., Bauer, J., & Held, R. (1993). Myopic children show insufficient accommodative response to blur. *Investigative Ophthalmology & Visual Science, 34*(3), 690-694.

Harmon, D. B. (1958). *Notes on a Dynamic Theory of Vision* (3rd ed.). Austin, TX: Research

Publications.

Hochberg, Y. (1988). A sharper Bonferroni procedure for multiple significance testing. *Biometrika, 75,* 800-803.

Jeffrey, B. G., Weisinger, H. S., Neuringer, M., & Mitchell, D. C. (2001). The role of docosahexaenoic acid in retinal function. *Lipids, 36*(9), 859-871.

Johnson, C., Saunders, M., & Mull, H. K. (1944). The effect of a carrot diet on near-sightedness. *American Journal of Psychology, 57,* 84-86.

Kerr, C. M., & Tappin, D. M. (2002). Do poor nutrition and display screens affect visual acuity in children? *British Journal of Community Nursing, 7*(2), 80-89.

Knapp, A. A. (1939). Vitamin-D complex in progressive myopia: Etiology, pathology, and treatment. *American Journal of Ophthalmology, 22,* 1329-1337.

Lane, B. C. (1982). Myopia prevention and reversal: New data confirms the interaction of accommodative stress and deficit-inducing nutrition. *Journal of the International Academy of Preventive Medicine, 7*(3), 17-30.

Liberman, J. (1995). *Take off your glasses and see: A mind/body approach to expanding your eyesight and insight*. New York: Three Rivers Press.

Makrides, M., Neumann, M., Simmer, K., Pater, J., & Gibson, R. (1995). Are long-chain polyunsaturated fatty acids essential nutrients in infancy? *Lancet, 345,* 1463-1468**.**

Morgan, I., & Rose, K. (2005). How genetic is school myopia? *Progress in Retinal and Eye Research, 24*(1), 1-38.

Morgan, R. W., Speakman, J. S., & Grimshaw, S.E. (1975). Inuit myopia: An environmentally induced "epidemic"? *Canadian Medical Association Journal, 112*(5), 575-577.

Mutti, D.O., & Zadnik, K. (2009). Has near work's star fallen? *Optometry and Vision Science,*

86(2), 76-78.

Orfield, A. (2007). *Eyes for learning: Preventing and curing vision-related learning problems.* Lanham, MD: Rowman & Littlefield Education.

Rose, K. A., Morgan, I. G., Ip, J., Kifley, A., Huynh, S., Smith, W., et al. (2008). Outdoor activity reduces the prevalence of myopia in children. *Ophthalmology, 115*(8), 1279-1285.

Rose, K. A., Morgan, I. G., Smith, W., Burlutsky, G., Mitchell, P., & Saw, S. M. (2008). Myopia, lifestyle, and schooling in students of Chinese ethnicity in Singapore and Sydney. *Archives of Ophthalmology, 126*(4), 527-530.

Saw, S. M., Katz, J., Schein, O. D., Chew, S. J., & Chan, T. K. (1996). Epidemiology of myopia. *Epidemiologic Reviews, 18*(2), 175-187.

Spitler, H. R. (1941). *The Syntonic Principle: Its relation to health and ocular problems*. Eaton, OH: The College of Syntonic Optometry.

Taylor, H. R., Robin, T. A., Lansingh, V. C., Weih, L. M., & Keeffe, J. E. (2003). A myopic shift in Australian aboriginals: 1977-2000. *Transactions of the American Ophthalmological Society, 101*, 107-112.

Walker, J. P. S. (1932). Progressive myopia: A suggestion explaining its causation, and for its treatment. *British Journal of Ophthalmology, 16*(8), 485-488**.**

Westfall, P., Tobias, R., Rom, D., Wolfinger, R., & Hochberg, Y. (1999). *Multiple comparisons and multiple tests using the SAS system.* Cary, NC: SAS Publishing.

Yoo, R., Logani, S., Mahat, M., Wheeler, N. C., & Lee, D. A. (1999). Vision screening of abused and neglected children by the UCLA Mobile Eye Clinic. *Journal of the American Optometric Association, 70*(7), 461-469.

Young, F. A., Leary, G. A., Baldwin, W. R., West, D. C., Box, R. A., Harris, E., et al. (1969). The transmission of refractive errors within Eskimo families. *American Journal of Optometry and Archives of American Academy of Optometry, 46*(9), 676-685.

Zylbermann, R., Landau, D., & Berson, D. (1993). The influence of study habits on myopia in Jewish teenagers. *Journal of Pediatric Ophthalmology and Strabismus, 30*, 319-322.

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Table 1.

Descriptive statistics and reliability estimates for 3 indices

Label	N Items	Mean	Std Dev	Min	Max	Cronbach's alpha
Psychological stress (hi=stressed)	15	2.01	0.58	1.00	3.14	0.81
Processed, fried, sugar, fast, canned	6	3.35	0.57	1.17	4.00	0.81
Fresh: carrots, berries, whole wheat	8	2.57	0.68	1.00	4.00	0.76

Note: Total score = average of Likert item scores.

Note: An additional index of meats and processed protein food was not reliable (Cronbach's $\alpha = .47$).

Table 2.

Differences between myopes vs. emmetropes: Descriptives, effect sizes, and significance

Scale	Myopes			Emmetropes			Differences		
	N	Mean or %	SD	*N*	Mean or %	SD	*ES*	Raw p	Bootstrap p
Psychological stress (hi=stressed)	197	1.93	0.58	175	2.11	0.57	0.31	0.003	0.008
Processed, fried, sugar, fast, canned	192	3.37	0.53	173	3.32	0.61	-0.09	0.365	0.743
Fresh: carrots, berries, whole wheat	192	2.48	0.69	172	2.68	0.68	0.29	0.005	0.016
Significant “common wisdom” items									
Biological father	142	38%	-	120	19%	-	-0.43	0.0008	0.011
Biological mother	162	52%	-	140	30%	-	-0.45	<.0001	0.001
Oldest male sibling	91	49%	-	85	16%	-	-0.71	<.0001	<.0001
Oldest female sibling	79	49%	-	70	24%	-	-0.52	0.0015	0.021
Amount of light on page	171	2.02	0.45	152	2.18	0.49	0.33	0.0003	0.004
Hours TV	190	2.58	0.84	169	2.25	0.85	-0.38	0.0006	0.008
Played outdoors often	194	3.58	0.72	175	3.80	0.47	0.33	0.0017	0.026

Note: ES = Effect size (Cohen, 1992), $d = (M_1 – M_2)/SD_{pooled}$; small/medium/large ~ .2/.5/.8 SDs.