

Can Presenting Symptoms be Associated with Long-Term Disease Severity in Patients with MS

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INTRODUCTION

Multiple sclerosis (MS) is an autoimmune demyelinating disease of the central nervous system. The disease is manifested in the inception and progression of such symptoms as declining visual acuity, sensory loss, motor weakness, and imbalance. Expanded Disability Status Scale (EDSS) scores and lesion volumes have historically been used as measures of the disease's severity.

OBJECTIVES

The current study aimed to establish an association between presenting symptoms and measures of disease severity (lesion volume, EDSS scores) and lab values (Vitamin A, Vitamin D, Beta carotene, and lipid panel levels) in Multiple Sclerosis patients.

METHODS

EDSS scores, vitamin A levels, retinal binding protein, beta carotene, vitamin D, lipids, and lesion volume were analyzed in 19 patients with RRMS. Patients were divided into four groups based upon their first presenting symptoms: visual (n=8), motor (n=3), sensory (n=3), and balance (n=5). Patients were then further subcategorized into racial groups (Hispanic white [n=8], non-Hispanic white [n=4], non-Hispanic black [n=7]). Average values of the lab values and lesion volumes were compared between the four groups. T-tests and ANOVA tests were performed. Correlation between vitamin A level and EDSS scores, lesion volumes, and lab values were also assessed. Lesion volume was calculated by processing MRIs of the brain in the software MIPAV. All values were taken at baseline.

RESULTS

T-tests and ANOVA tests garnered no significant differences in EDSS scores, lesion volumes, or lab values across all presenting groups. In general, correlations between vitamin A level and other biomarkers and measures of disease severity were insignificant. The only exceptions were positive correlations seen between vitamin A levels and retinal binding protein levels in the visual group (Correlation: 0.97188, P=5.50E-05) and in the balance group (Correlation: 0.906895, P=0.033674). The average vitamin A levels (mcg/dL) were lowest in patients presenting with sensory (51) and balance symptoms (54) compared to those first presenting with motor and sensory symptoms. Beta carotene (mcg/dL) was lowest on average in patients presenting with visual symptoms (14.75) compared with those first afflicted with motor (18.67), sensory (15.33), or balance (25.80) associated symptoms. Average lesion volume (mm³) of patients in the visual (17910) and balance (14427) groups were greater than that of lesion volumes in the motor (5945) and sensory (6829) groups. Patients presenting with visual symptoms (39.5125) had lower average vitamin D (ng/mL) versus patients presenting with balance (45.38). Hispanic white patients presented with more visual symptoms (4 of 8 patients) and non-Hispanic black patients were symptomatic of balance issues (5 of 6 patients).

GROUP	EDSS	VITAMIN A (mcg/dL)	RBP (mg/dL)	CAROTENE (mcg/dL)	VIT D (ng/mL)	TC (mg/dL)	HDL (mg/dL)	LDL (mg/dL)	TGL (mg/dL)	Lesion Volume (mm ³)
1	4.75	62.125	4.15	14.75	39.5125	195.875	46.5	127.25	112.25	17910.36
2	4.5	69.33333	5	18.66667	39.46667	203.6667	74	95.66667	170.3333	5944.795
3	2.666667	51	4.033333	15.33333	36.13333	183	53	114.3333	77.66667	6828.94
4	4.3	54	3.78	25.8	45.38	178.6	63	93.4	133.8	14426.74

Table 1. Average EDSS, lesion volume, and lab value scores across all groups. The average scores in each category of the visual (Group 1), motor (Group 2), sensory (Group 3), and balance (Group 4) groups are illustrated.

GROUP	EDSS	RBP (mg/dL)	CAROTENE (mcg/dL)	VIT D (ng/mL)	TC (mg/dL)	HDL (mg/dL)	LDL (mg/dL)	TGL (mg/dL)	Lesion Volume (mm ³)
1	0.086617	0.97188	0.013486	-0.34636	-0.26043	-0.47447	-0.28157	0.3322	-0.25021
2	0.669238	0.669238	-0.88443	-0.41677	0.980432	0.995268	-0.99687	0.417832	0.820027
3	0.833092	0.966547	0.152831	0.154809	-0.05881	-0.02857	0.071275	-0.72919	-0.98033
4	0.047562	0.906895	-0.61478	0.183478	0.575854	-0.06367	0.636813	0.236771	-0.72168

Table 2. Correlation between vitamin A level and measures of disease severity and lab values. Correlation scores between vitamin A level and measures of disease severity and between vitamin A level and lab values are depicted across all groups. Correlation was significant between vitamin A levels and retinal binding protein levels in the visual group (Correlation: 0.97188, P=5.50E-05) and in the balance group (Correlation: 0.906895, P=0.033674). All other correlation scores were insignificant (P < 0.05).

GROUPS	EDSS	VITAMIN A (mcg/dL)	RBP (mg/dL)	CAROTENE (mcg/dL)	VIT D (ng/mL)	TC (mg/dL)	HDL (mg/dL)	LDL (mg/dL)	TGL (mg/dL)	Lesion Volume (mm ³)
1, 2	0.855613	0.554066	0.131005	0.609887	0.996093	0.804027	0.038198	0.245905	0.08279	0.063532
1, 3	0.081536	0.284297	0.799045	0.929801	0.723229	0.709358	0.237454	0.661088	0.257752	0.091367
1, 4	0.696692	0.325648	0.369331	0.088135	0.588156	0.544217	0.009676	0.196692	0.706306	0.518317
2, 3	0.31308	0.351262	0.379195	0.772609	0.528734	0.573201	0.327286	0.483507	0.050123	0.786717
2, 4	0.914389	0.2994	0.17676	0.490806	0.687565	0.445958	0.492861	0.935427	0.705706	0.153406
3, 4	0.29653	0.783319	0.738314	0.260715	0.538144	0.90603	0.202606	0.53401	0.562453	0.222057
1, 2, 3, 4	0.4929	0.459542	0.307842	0.383603	0.867078	0.86008	0.053803	0.459542	0.600959	0.111502

Table 3. Statistical analysis of all presenting symptom groups. The results of the T-tests and ANOVA tests across all presenting symptom groups are illustrated. With the exception of the HDL level comparison between the visual and balance groups (P=0.009676), all differences were insignificant (P>0.5).

Retinal Binding Protein Level (mg/dL) as a Function of Vitamin A Level (mcg/dL) in the Visual and Balance Groups

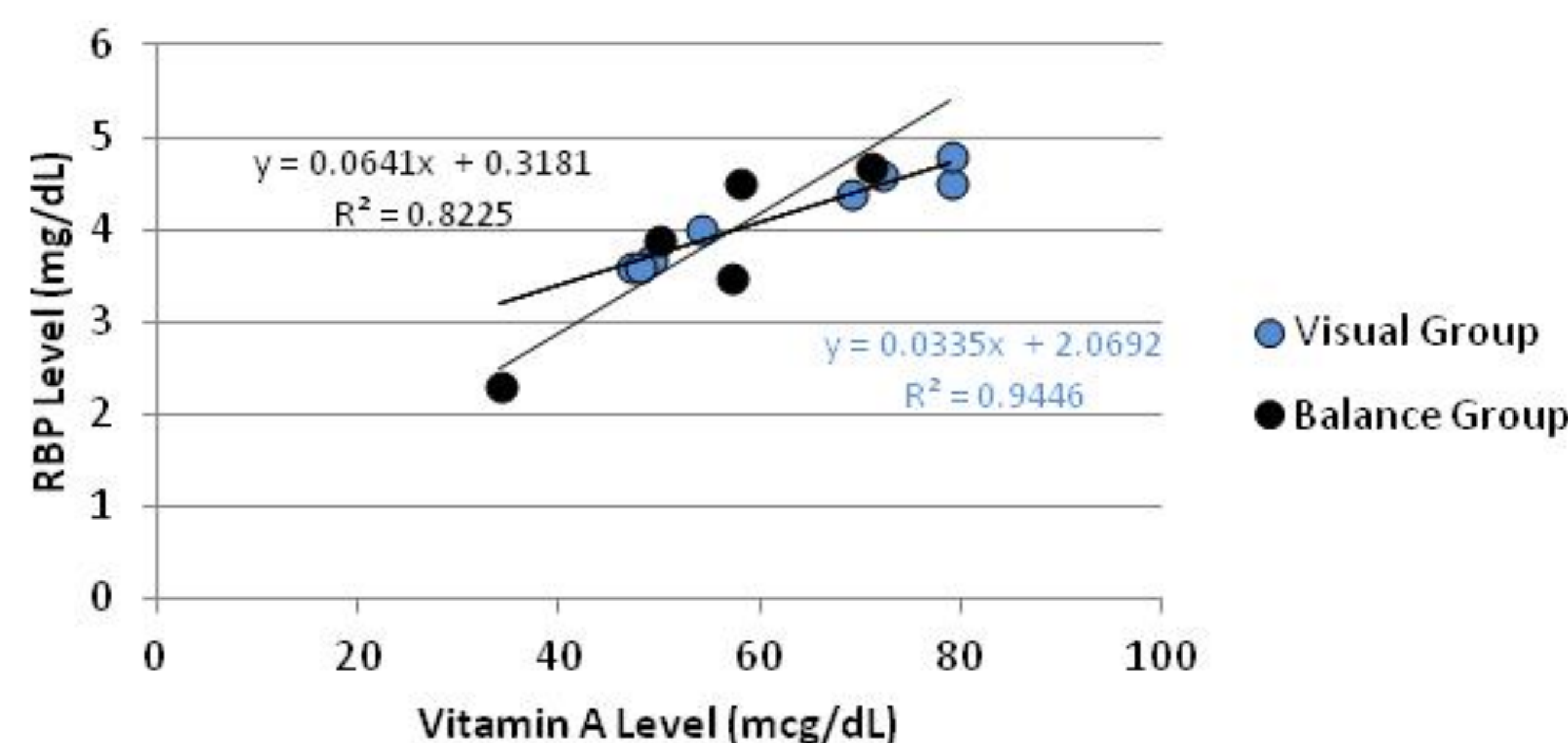


Figure 1. Linear regression models of retinal binding protein level (mg/dL) as a function of vitamin A level of patients in the visual and balance groups. The linear regression models of the RBP levels of the visual group and of the balance group are illustrated with their respective linear equations and R squared values. Significantly positive correlation was seen between vitamin A level and RBP level in both presenting symptom groups (P=5.50E-05, P=0.033674, respectively).

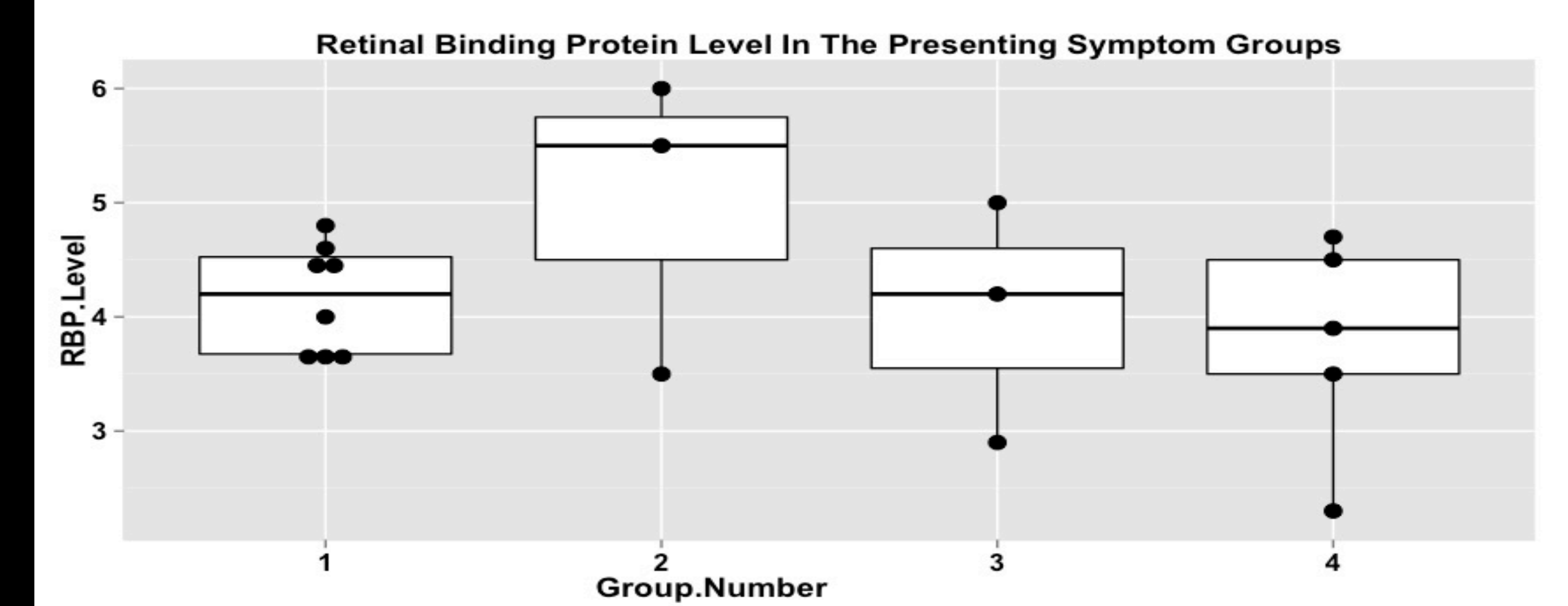


Figure 2. Retinal binding protein level (mg/dL) in all presenting symptom groups. A box-dotplot of the retinal binding protein level of each patient in all presenting symptom groups. Greatest average RBP levels (mg/dL) were seen in the motor group (Group 2, Average: 5.00 mg/dL). Lowest average RBP levels (mg/dL) were seen in the balance group (Group 4, Average: 3.78 mg/dL). Positive correlation was seen between RBP level and vitamin A level in the visual and balance groups (Group 1 and Group 4, respectively).

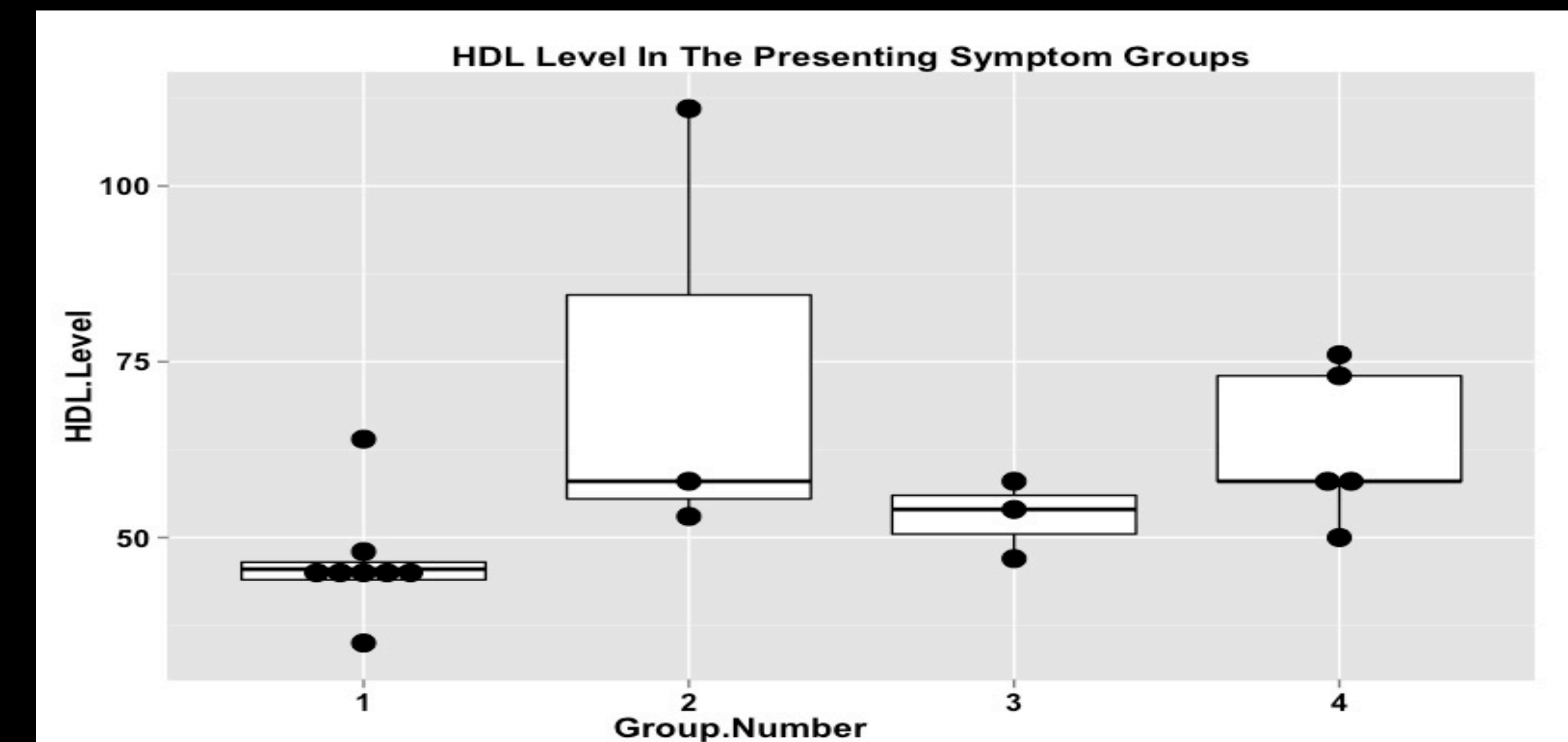


Figure 3. High-density lipoprotein level (mg/dL). A box-dotplot of the high-density lipoprotein level of each patient in all presenting symptom groups. Greatest average HDL level (mg/dL) was seen in the motor group (Group 2, Average: 74 mg/dL). Lowest average HDL level (mg/dL) was seen in the visual group (Group 1, Average: 46.5 mg/dL). A t-test revealed a significant difference between HDL levels in the visual and balance groups.

CONCLUSION

Overall, significant differences were not seen across the four presenting symptom groups. Lab values taken at baseline did not correlate to vitamin A level in any meaningful way with respect to presenting symptoms, nor did measures of disease severity. Further analysis is required to determine if statistically significant differences truly exist, as the sample size involved was low (n<20), and some groups having less than five subjects.

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