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THE EFFECT OF DARK CHOCOLATE CONSUMPTION ON INTRAOCULAR PRESSURE OF YOUNG ADULTS IN SANGO OTA, OGUN STATE, NIGERIA.

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ABSTRACT

The study investigated the effect of dark chocolate consumption on the Intraocular Pressure (IOP) of young adults. Participants were volunteers of both sexes who visited Scorpio Eye Clinic Ogun State. A total number of 120 healthy individuals (60 males and 60 females), between the ages of 18-35 years old were involved in this study. Three initial IOP values were taken, when each subject entered the clinic, using a keeler non-contact pulsair tonometer and an average of these initial values was recorded as baseline IOP. Subsequently, IOPs were measured on both eyes, at an interval of 30mins each i.e 30mins, 60mins and 90mins after consumption of 10.5g of dark chocolate. A portion of the dark chocolate was cut and measured on the scale to ensure accurate amount of chocolate to be administered. A group of three consecutive readings with variation of less than 3mmgh was considered to be an acceptable result and averaged for analysis. An alpha level of 0.05 was used to detetmine statistical significance using SPSS program for Windows, (v16; SPSS Inc, Chicago, IL). Results from this study clearly showed that consuming 10.5g of dark chocolate has a significant decrease effect on the IOP of young adults. Similarly, intraocular pressure decrease was also gender dependent, as male subjects had more IOP decrease than female subjects. Results from the study will play important role in the management of patients with ocular hypertension and in glaucoma management in general.

Keywords*: Intraocular Pressure, Dark chocolate, Ocular hypertension, Glaucoma.*

INTRODUCTION

Elevated intraocular pressure (IOP) is an important aspect in the evaluation of patients at risk of glaucoma. The normal IOP range falls between 11-21mmHg, thus an eye is said to have a high IOP if the measured value is greater than 21mmHg. Elevated IOP, if not treated, might lead to destruction of the optic nerve, leading to glaucoma. Glaucoma is characterized by a slowly progressive damage of the optic nerve head and loss of retina fiber layer in combination with visual field changes, resulting to increased excavation of the optic disc. Glaucoma can also lead to peripheral visual loss and ultimately loss of sight. Hence, it is the aim of this study to investigate the effects of chocolate consumption on the IOP of young adults. Dark chocolate is a form of chocolate which is made from cocoa butter instead of milk-based butter. It contains a higher percentage of cocoa; hence it is one of the best sources of antioxidants on the planet. It is richly packed with antioxidants such as polyphenols and flavonoids. Hence consuming antioxidant rich food like dark chocolate can protect from many types of cancer and slow signs of ageing [1].

If IOP rises above 21mmHg, with all factors being constant, it is regarded as high IOP, whereas if it falls below 10mmHg, with all factors being constant, it is regarded as low IOP. In glaucoma, the IOP is dangerously elevated. Since the optic nerve is highly vulnerable to damage by increased IOP, loss of vision may ensue. Glaucoma is a group of disorders characterized by a progressive optic neuropathy resulting in a characteristic appearance of the optic disc and a specific pattern of irreversible visual field defects that are associated frequently but not invariably with raised intraocular pressure [2]. Dark chocolate contains a wide variety of antioxidants including flavonols and polyphenols which have been shown to reduce systolic and diastolic blood pressure. Due to the relationship between blood pressure and intraocular pressure, there may also be a possible reduction in IOP after the consumption of dark chocolate. This study was therefore carried out to investigate the acute effect of consumption of 10.5g of dark chocolate on IOP of healthy young adults.

ETHICAL CONSIDERATIONS

Ethical approval was obtained from

*The research committee, Department of Optometry, Madonna University.

* In line with the standard practices for research studies, a verbal consent was obtained from each participant after details of the study procedures

had been explained. Participants were treated with care and love. Confidential issues were treated confidential.

STUDY DESIGN

An experimental design was used to investigate the effect of chocolate consumption on IOP of young adults. This research design was implored because it allowed the researcher to manipulate the variables in order to establish a cause and effect relationship.

STUDY POPULATION

The population for this study comprised healthy young adults of both gender between the ages of 18 to 35years recruited from Scorpio Eye Clinic. This group was chosen because they are old enough to understand and comply with the experimental procedure and because this project centers majorly on young adults.

AREA OF STUDY

The area of study was Scorpio Eye Clinic, Sango Ota, Ogun State, South Western Nigeria, a well-equipped Eye Center.

SAMPLE SIZE AND SAMPLING TECHNIQUE

convenient sampling technique was used for this study and a total of 120 subjects as sample size.

INCLUSION AND EXCLUSION CRITERIA

Participants who were involved in this study include

- Healthy adults of both males and females between the ages of 18 to 35years who visited Scorpio Eye Clinic.
- Patients with normal IOP value (11-21mmHg.)
- Participants who gave their consent to be involved in this study.
- Patients who do not have any medical history of either hypertension or diabetes mellitus.

Participants that were not involved in this study include

- Patients who are older than 35years old.
- Patients who are below 18 years old.
- Patients who did not give their consent to be involved in this study.
- Patients who had an ocular history of glaucoma or a medical history of hypertension.

- Patients whose IOP value is relatively high.

INSTRUMENTS FOR DATA COLLECTION

Instruments used in this study include:

- Penlight.
- Ophthalmoscope (Keeler professional direct ophthalmoscope).
- 10.5g chocolate bars.
- Non-contact tonometer (Keeler pulsair tonometer).
- Foil wrappers
- A measuring scale

PROCEDURE FOR DATA COLLECTION

Participants abstained from chocolate containing food for 48 hours prior to and during the study. Three initial IOP values were taken when the subject entered the clinic, and an average of these initial values was recorded. IOP were measured on both eyes of 120 participants, at an interval of 30mins each i.e. 30mins, 60mins and 90mins after consumption of 10.5g of dark chocolate. A group of three consecutive readings with variation of less than 3 mmHg was considered to be an acceptable result and averaged for analysis using a Keeler non-contact pulsair tonometer. All measurements were taken using the same instrument and by one examiner.

DATA ANALYSIS

The results for all subjects at each time point, for each group, were combined and presented as the means (±standard deviation), to allow for statistical comparison. Significance of variations across measured variables was tested using the student *t*-test. The pre-test and post-test data were analyzed using a paired-sample *t*-test. An alpha level of 0.05 was used to determine statistical significance using the SPSS program for Windows, (v 16; SPSS Inc, Chicago, IL).

RELIABILITY AND VALIDITY

Tests were accurately carried out and average values for each procedure was obtained with standard optometric instruments approved by the World council of Optometry (WCO) and Optometrists and Dispensing Opticians registration board of Nigeria (ODORBN).

RESULTS

Data Screening

Data was screened for missing variables, outliers and normality of distributions.

Demographic Characteristics of Study Participants

A total of 120 subjects participated in this study. There were no missing variables or outliers and the data was normally distributed by inspection of box plots and histogram. Their age ranged from 18 to 35years with a mean age of 26.30±5.049years.

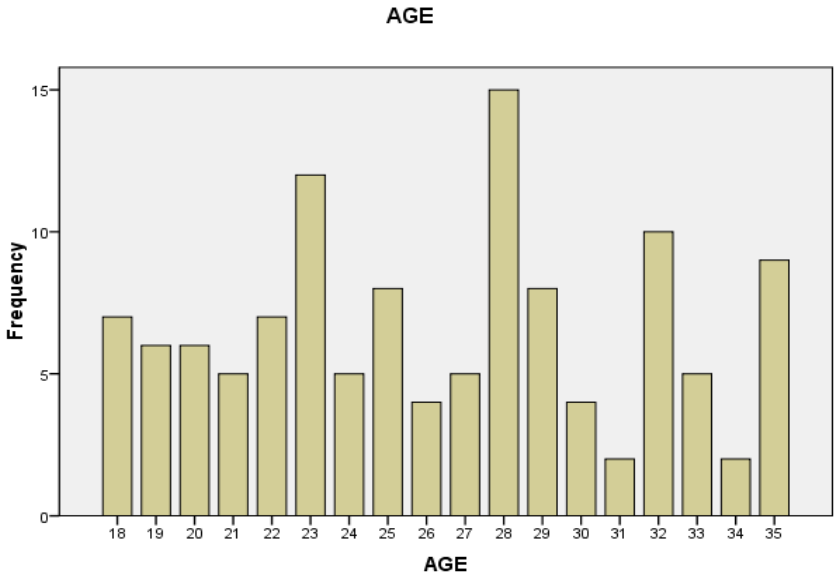

Figure 1: Bar chart showing age distribution of study participants

R.Q 1 Will the consumption of 10.5g of dark chocolate cause any change in intraocular pressure?

Table 1 Shows the comparison of mean values of IOP levels at different time intervals after the administration of dark chocolate using T-test.

Time (min)	Mean ± SD (of IOP in mmHg)
Baseline	17.00±2.086
30mins	16.44±2.199
60mins	15.82±1.956
90mins	15.54±1.961
P value	<0.05

From table 1 above, baseline IOP was reduced from 17.00mmHg to 15.54mmHg after 90mins of consuming 10.5g of dark chocolate. Thus, consumption of 10.5g of dark chocolate caused a change in intraocular pressure.

Hypothesis

H_O: There is no significant change in IOP after the consumption of 10.5g of dark chocolate ($p<0.05$).

H_A: There is significant change in IOP after the consumption of 10.5g of dark chocolate ($p>0.05$).

$H_O$was rejected, H_A was accepted ($P< 0.05$) which means dark chocolate has significant effect on intraocular pressure. Refer to table 1 above.

R.Q 2 Is the change in IOP gender dependent?

Table 2 Shows the comparison of mean values of females' intraocular pressure levels at different time intervals after the administration of dark chocolate.

Time (min)	Mean ± SD (of IOP in mmHg)
Baseline	17.07±2.328
30mins	16.57±2.486
60mins	16.03±2.155
90mins	15.77±2.235
P value	< 0.05

Table 3 Shows the comparison of mean values of males' intraocular pressure levels at different time intervals after the administration of dark chocolate.

Time (min)	Mean ± SD (of IOP in mmHg)
Baseline	16.93±1.831
30mins	16.32±1.882
60mins	15.62±1.728
90mins	15.32±1.631
P value	< 0.05

Tables 2 and 3 above, when compared answers research question 2, based on the observable difference in the intraocular pressure between males (15.32mmHg) and females (15.77mmHg), after 90mins of dark chocolate

consumption. Thus, the effect of dark chocolate consumption is gender dependent.

Table 4 Compares the mean values of females and males intraocular pressure levels at different time intervals after the administration of dark chocolate.

Time (min)	Mean ± SD (IOP female)	Mean ±SD (IOP male)	P value
Baseline	17.07±2.328	16.93±1.831	< 0.05
30mins	16.57±2.486	16.32±1.882	< 0.05
60mins	16.03±2.155	15.62±1.728	< 0.05
90mins	15.77±2.235	15.32±1.631	< 0.05

H_O: The change in IOP is not gender dependent (p<0.05).

H_A: The change in IOP is gender dependent (p>0.05).

H_O was rejected, H_A was accepted(P<0.05), which means the change in IOP after the consumption of dark chocolate was influenced by gender. From table 4 above, the decrease in IOP in females (from 17.07mmHg to 15.77mmHg after 90mins of chocolate consumption) was less than the decrease in IOP observed in males (from 16.93mmHg to 15.32mmHg after 90mins of chocolate consumption).

R. Q 3 Will the consumption of 10.5g chocolate, increase or decrease the IOP of the subjects?

From table 1 above, consumption of 10.5g of dark chocolate caused a significant decrease in intraocular pressure.

DISCUSSION

Results from this study indicate that there was a lowering effect on the intraocular pressure of young subjects after consumption of 10.5g of dark chocolate, and this is consistent with a study carried out by [3]. Although the magnitude of IOP reduction was small, the effects are clinically noteworthy. In this study, the precise mechanism responsible for the presumed IOP-lowering effect of dark chocolate is not fully stated. However, other studies show that dark chocolate is richly packed with phytochemicals such as flavanols and polyphenols which aids in the production of nitric oxide which has an effect on the blood vessels in the system leading to reduction in blood pressure [4]. Many studies have been conducted to ascertain the relationship between BP and consumption of cocoa based products. On the other hand, other researches have been

carried out to establish relationship between BP and IOP, and results from these studies indicated that lowering blood pressure can also lead to decrease in IOP [5].

CONCLUSION

Uncontrolled rise in IOP is one predisposing factor that leads to primary open angle glaucoma. Treatment of glaucoma is majorly targeted at reducing increased IOP in the affected eye. Result obtained from this study shows that dark chocolate reduces IOP in normotensive males and females significantly.

RECOMMENDATIONS OF THE STUDY

The researchers recommend that consumption of cocoa or cocoa based products should be inculcated into our daily diet, as it does not only have a positive effect to the eye, but also the heart and entire body system as a whole as briefly stated in this study. Similarly, the researchers also recommend health education of the populace on the importance of adequate diet in maintaining both eye health and good health in general.

REFERENCES

Subhashini, R., Mahadeva, R., Sumathi, P., Gunalan, G. (2010) A Comparative Phytochemical Analysis of Cocoa and Green Tea.*Indian Journal of Science and Technology.* [Online]3(2). Available from: http://www.indjst.org [Accessed: 26th March2018].

Khurana, A.K. (2012*) Comprehensive Ophthalmology.* Fifth Edition. New Age International Publisher, New Delhi.

Odogwu C.C., 2016 "Effects of Dark Chocolate on Intraocular Pressure seen in Madonna University Teaching Hospital, Elele, Rivers State*" OD Thesis*, Department of Optometry, Madonna University, Elele, Rivers State, Nigeria.

Desch, S., Schmidt, J., Kobler, D., Sonnabend, M., Eitel, I., *et al.* (2010) Effect of Cocoa Products on Blood Pressure: Systemic Review and Meta-Analysis.*American Journal of Hypertension*. [Online] Available from: *doi:10.1038/ajh.2009.213* [Accessed: 24th January 2018].

Nwaokoro, N.A., 2015, 'Relationship Between High Blood Pressure and Intraocular Pressure Among Patients Seen in Mercy Eye Clinic

AbakAkwa-Ibom State' *OD Thesis*, Department of Optometry, Madonna University, Elele, Rivers State, Nigeria.

S/N	AGE	SEX	Baseline IOP OD mmHg	Baseline IOP OS MmHg	IOP after 30min OD	IOP after 30min OS	IOP after 60min OD	IOP after 60min OS	IOP after 90min OD	IOP after 90min OS
1	23	F	16	18	15	18	15	17	18	17
2	32	F	21	20	21	20	19	18	19	19
3	20	F	15	13	14	13	13	12	15	11
4	35	F	20	20	19	19	18	18	18	18
5	35	F	17	18	16	18	16	17	17	18
6	27	F	16	16	16	16	15	15	14	15
7	23	F	19	21	17	20	17	19	19	21
8	23	F	21	21	21	20	19	19	18	17
9	32	F	21	20	20	19	19	19	20	18
10	30	F	18	17	18	17	17	16	15	14
11	28	F	19	16	17	15	17	15	15	15
12	22	F	15	15	13	15	13	14	12	14
13	35	F	21	20	20	20	19	19	18	19
14	21	F	17	15	16	14	15	14	17	15
15	33	F	14	15	13	14	13	14	13	14
16	28	F	17	17	16	17	17	17	15	16
17	32	F	15	15	15	14	13	14	13	14
18	21	F	20	18	20	18	18	17	18	16
19	24	F	19	18	21	17	19	17	20	19
20	28	F	20	20	20	19	19	20	18	19
21	35	F	17	18	16	18	15	16	15	17
22	35	F	18	17	18	17	16	17	16	17
23	32	F	13	15	15	14	14	13	14	14
24	20	F	12	13	13	13	13	14	12	14
25	25	F	18	18	17	16	16	16	17	16
26	31	F	20	17	20	16	19	15	19	15
27	18	F	18	17	16	16	17	15	16	15
28	23	F	18	18	18	16	17	18	16	17
29	33	F	16	15	15	15	14	14	13	14
30	29	F	13	14	13	14	12	12	13	12
31	19	F	14	14	12	13	11	13	12	12
32	18	F	18	18	17	16	18	17	17	17
33	24	F	20	20	22	18	20	17	19	17
34	19	F	18	18	17	18	17	16	17	16
35	23	F	14	15	12	13	12	13	12	13
36	28	F	16	18	15	19	16	17	15	17
37	20	F	18	18	18	18	19	18	19	18
38	22	F	16	16	15	16	17	15	17	15
39	28	F	19	19	19	19	17	18	17	18
40	32	F	17	17	19	17	18	16	17	15
41	35	F	18	17	17	16	17	16	16	16
42	20	F	14	14	15	14	14	15	12	14
43	29	F	17	17	15	16	16	16	16	16
44	25	F	20	19	19	17	19	18	19	17
45	23	F	18	18	19	18	17	17	17	19
46	24	F	14	15	14	15	15	14	14	15
47	26	F	19	20	17	17	16	17	16	17
48	20	F	15	14	16	14	15	14	15	14
49	21	F	17	18	16	16	16	16	16	17
50	18	F	12	12	12	15	14	14	14	14
51	18	F	15	16	14	17	15	16	13	16
52	23	F	17	17	15	16	15	17	14	16

53	28	F	19	19	19	18	18	18	18	18
54	33	F	18	17	17	17	17	16	17	16
55	34	F	17	18	16	17	16	16	15	16
56	18	F	15	15	14	13	14	14	14	14
57	23	F	17	18	17	19	15	18	15	17
58	27	F	18	19	17	18	17	17	17	18
59	32	F	16	16	16	15	14	15	15	15
60	25	F	14	14	14	14	13	14	13	14
61	30	M	19	19	18	18	18	17	17	17
62	29	M	17	17	16	16	15	15	15	14
63	26	M	15	17	15	17	14	16	13	16
64	33	M	20	21	19	20	18	19	19	18
65	28	M	19	19	17	17	17	16	16	15
66	31	M	16	18	15	16	15	16	14	16
67	28	M	18	15	16	14	16	14	17	13
68	27	M	17	17	16	16	15	15	16	14
69	29	M	16	16	14	15	14	14	14	14
70	35	M	21	21	21	20	19	19	18	19
71	28	M	17	18	16	17	15	16	16	16
72	32	M	17	15	15	14	15	13	14	14
73	35	M	20	21	18	19	18	18	18	18
74	22	M	16	15	15	14	14	14	14	13
75	28	M	18	18	17	16	16	16	17	17
76	32	M	19	20	20	20	18	19	18	19
77	28	M	16	14	16	12	15	12	15	12
78	19	M	14	14	14	14	14	15	14	15
79	21	M	17	18	16	19	15	16	15	16
80	28	M	18	18	16	17	16	17	16	17
81	23	M	17	20	18	21	16	20	16	19
82	25	M	16	14	15	14	15	15	14	14
83	33	M	17	17	17	16	16	16	15	16
84	34	M	18	18	19	18	18	19	16	17
85	30	M	17	17	16	16	14	17	15	16
86	29	M	21	21	20	19	19	19	18	19
87	25	M	16	18	17	19	15	18	16	18
88	20	M	14	16	14	16	14	15	14	15
89	26	M	15	15	13	16	14	15	14	15
90	32	M	18	18	17	16	17	16	16	17
91	35	M	16	20	16	19	15	18	15	18
92	18	M	15	15	15	15	13	14	13	14
93	19	M	15	14	16	13	14	13	14	13
94	25	M	17	16	16	16	15	16	15	16
95	28	M	21	20	19	19	19	18	18	18
96	23	M	16	17	14	16	15	17	14	16
97	23	M	16	21	15	20	15	19	15	15
98	22	M	13	14	13	14	12	13	12	14
99	24	M	18	17	17	17	16	16	16	15
100	19	M	17	17	15	16	15	14	14	15
101	28	M	14	14	12	12	12	13	12	13

102	27	M	17	17	16	17	16	15	16	16
103	23	M	16	18	19	18	17	17	17	17
104	29	M	20	16	19	16	19	15	18	15
105	29	M	17	18	16	17	16	16	15	16
106	32	M	15	18	16	17	14	16	14	16
107	22	M	16	17	15	14	15	16	14	15
108	24	M	18	16	19	18	17	17	16	17
109	19	M	15	18	15	19	13	17	13	17
110	22	M	16	14	17	15	16	13	15	13
111	25	M	18	18	16	17	17	17	16	17
112	27	M	19	18	18	18	17	17	17	16
113	30	M	17	21	18	19	16	19	16	19
114	28	M	16	17	16	15	14	15	14	15
115	25	M	17	16	15	17	16	16	16	16
116	26	M	16	17	18	17	16	15	14	15
117	22	M	19	19	17	17	18	17	18	17
118	21	M	18	16	17	15	17	15	16	15
119	18	M	14	15	15	14	14	13	14	13
120	29	M	15	15	13	13	13	14	13	13

APPENDIX I
INTRAOCULAR PRESSURE BEFORE AND AFTER CONSUMPTION OF DARK CHOCOLATE IN BOTH MALES AND FEMALES

APPENDIX II

One-Sample Statistics showing mean IOP of subjects at different time intervals

	N	Mean	Std. Deviation	Std. Error Mean
SN	120	60.50	34.785	3.175
AGE	120	26.30	5.049	.461
BASELINE IOP IN OD	120	17.00	2.086	.190
IOP AFTER 3O MINS IN OD	120	16.44	2.199	.201
IOP AFTER 60 MINS IN OD	120	15.82	1.956	.179
IOP AFTER 90 MINS IN OD	120	15.54	1.961	.179

One Sample Test Showing Mean IOP of Participants at Different Time Intervals

	Test Value = 0					
	t	Df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
SN	19.053	119	.000	60.500	54.21	66.79
AGE	57.065	119	.000	26.300	25.39	27.21
BASELINE IOP IN OD	89.258	119	.000	17.000	16.62	17.38
IOP AFTER 3O MINS IN OD	81.894	119	.000	16.442	16.04	16.84
IOP AFTER 60 MINS IN OD	88.623	119	.000	15.825	15.47	16.18
IOP AFTER 90 MINS IN OD	86.802	119	.000	15.542	15.19	15.90

Group Statistics Showing Mean IOP in Males and females

	GENDER	N	Mean	Std. Deviation	Std. Error Mean
SN	F	60	30.50	17.464	2.255
	M	60	90.50	17.464	2.255
BASELINE IOP OD IN mmHg	F	60	17.07	2.328	.301
	M	60	16.93	1.831	.236
IOP AFTER 3O MINS OD	F	60	16.57	2.486	.321
	M	60	16.32	1.882	.243
IOP AFTER 60 MINS OD	F	60	16.03	2.155	.278
	M	60	15.62	1.728	.223
IOP AFTER 90 MINS OD	F	60	15.77	2.235	.289
	M	60	15.32	1.631	.211

Independent Samples Test Comparing Mean IOP Between Males and Females

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	T	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
SN	Equal variances assumed	.000	1.000	-18.818	118	.000	-60.000	3.189	-66.314	-53.686
	Equal variances not assumed			-18.818	118.000	.000	-60.000	3.189	-66.314	-53.686
BASELINE IOP OD IN mmHg	Equal variances assumed	4.016	.047	.349	118	.728	.133	.382	-.624	.890
	Equal variances not assumed			.349	111.786	.728	.133	.382	-.624	.891
IOP AFTER 3O MINS OD	Equal variances assumed	5.199	.024	.621	118	.536	.250	.403	-.547	1.047
	Equal variances not assumed			.621	109.900	.536	.250	.403	-.548	1.048
IOP AFTER 60 MINS OD	Equal variances assumed	3.272	.073	1.168	118	.245	.417	.357	-.289	1.123
	Equal variances not assumed			1.168	112.686	.245	.417	.357	-.290	1.123
IOP AFTER 90 MINS OD	Equal variances assumed	7.758	.006	1.260	118	.210	.450	.357	-.257	1.157
	Equal variances not assumed			1.260	107.960	.210	.450	.357	-.258	1.158