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ORIGINAL ARTICLE

Policosanol on Lipid Profile and Blood Pressure in Pre-Hypertensive and Grade I Hypertensive Cuban Patients

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Abstract

Background: Policosanol has beneficial effects on the lipid profile and the vascular system. Meta-analyses of previous clinical trials concluded that policosanol can reduce blood pressure. This post-hoc analysis evaluated the effects of policosanol on the lipid profile and blood pressure in Cuban patients with prehypertension and stage I hypertension

Methods: A multicenter, randomized, double-blind, placebo-controlled clinical trial was conducted. Patients with pre-hypertension or grade I hypertension were randomized to receive policosanol 20 mg/day or placebo for 12 weeks. The primary efficacy endpoint was lipid profile progression. Changes in blood pressure were predetermined as secondary efficacy endpoints. Physical and blood safety indicators, as well as adverse events (AE), were monitored. Statistical analysis was performed using the intention-to-treat method.

Results: Four hundred patients: 296 women, 104 men (mean age 46.3 years), with pre-hypertension or grade I hypertension were eligible for randomization. Groups were homogeneous at baseline. At study completion, Policosanol significantly lowered low-density lipoprotein-cholesterol (LDL-C), total cholesterol and increased high-density lipoprotein-cholesterol (HDL-C) in these patients. Policosanol significantly reduced blood pressure vs baseline and placebo. Policosanol was safe and well tolerated, not significantly changing any safety indicator. Twelve patients reported AE, all transient, with similar frequency in both groups.

Conclusions: Policosanol (20 mg/day) for twelve weeks produced beneficial changes on the lipid profile and was effective for lowering blood pressure to Cuban patients with pre-hypertension and grade I hypertension, being safe and well tolerated.

Keyword

Policosanol, Lipid profile, Blood pressure, Pre-hypertension, Grade I hypertension

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Introduction

Policosanol is a mixture of high molecular weight primary alcohols isolated from sugarcane wax (*Saccharum officinarum*, L.), with cholesterol-lowering effects that include reductions in low-density lipoprotein cholesterol (LDL-C) and total cholesterol, and increases in high-density lipoprotein cholesterol (HDL-C) [1]. Meta-analyses have supported the lipid-modifying efficacy of policosanol [2-4].

Policosanol reduces cholesterol by inhibiting cholesterol synthesis through modulation of the enzyme hydroxymethylglutaryl coenzyme A (HMGCoA) reductase by AMPK activation [5-9].

In addition, policosanol exhibits beneficial pleiotropic effects in the prevention of atherothrombotic complications, such as the inhibition of platelet aggregation and LDL oxidation [10-15].

Both studies conducted in Cuban patients with high cardiovascular risk, which included a high frequency of hypertensive patients [16-19], and recent clinical studies in Korean and Japanese subjects revealed that policosanol significantly reduced blood pressure [20-23]. A meta-analysis concluded that policosanol could reduce blood pressure, but further studies are needed to confirm these results [24].

Given the excellent safety profile of policosanol [1,16-24,25-27], this could be a useful option to help control blood pressure, provided that larger clinical trials confirm this benefit.

Hypertension is recognized as the leading cause of cardiovascular disease and the main contributor to global mortality [28-30] and the impact of reducing blood pressure on cardiovascular improvement and all-cause mortality has been demonstrated [31].

Hence, this post-hoc analysis investigate the effects of policosanol 20 mg/day on lipid profile and blood pressure values in patients with pre-hypertension or grade I hypertension.

Participants and Methods

Study design

Multicenter, randomized, double-blind, placebo-controlled clinical trial, in which patients were recruited in six polyclinics in Havana.

The study protocol was approved by the Institutional Review Board (IRB)(IRB-120721) and registered in the Cuban Public Registry of Clinical Trials (RPCEC00000377). The study complied with the ethical principles established in the latest version of the Declaration of Helsinki and Tokyo for research involving human subjects [32]. All participants provided written informed consent at the time of enrollment.

Recruited patients were eligible for randomization if they met the inclusion criteria and did not meet exclusion criteria, and were instructed to follow healthy lifestyle actions for hypertension management.

Eligible patients were randomly allocated to receive either policosanol 20 mg or placebo tablets (visit 2) for 12 weeks. Patients were seen at baseline (visit 2) and after 4, 8, and 12 weeks on therapy (visits 3 to 5). Patients were examined every 4 weeks for blood pressure measurements, while laboratory analyses were conducted at baseline and at the end of the treatment period. At each visit, physical signs, compliance with study drugs and adverse events (AE) were assessed.

Study participants

Enrolled participants were men and women between 20 and 60 years of age, diagnosed with pre-hypertension (SBP:120-139 mmHg and DBP:80-89 mmHg) or with grade I hypertension (SBP: 140-159 mmHg and DBP: 90-99 mmHg), with 0-2 cardiovascular risk factors, such as smoking, dyslipidemia, overweight and sedentarism.

Exclusion criteria included having other grades of hypertension such as grade II (SBP:160-179 mmHg, DBP:100-109 mmHg), grade III (SBP ≥180 mmHg, DBP ≥ 110 mmHg), isolated systolic hypertension (SBP ≥ 140 mm Hg) and isolated diastolic hypertension (DBP > 90 mmHg); diagnosed vascular diseases (cardiovascular, cerebrovascular, peripheral vascular, among others); serious mental illness, malignant neoplastic diseases, pregnant women or those planning a pregnancy , nursing mothers; suspected or definite allergy to any ingredient of the study medications, prior intake of any antihypertensive drug and any condition which could pose a risk for study patients.

Inclusion criteria were defined simply as patients who complied with the enrollment criteria and did not show any exclusion criteria would be eligible for randomization.

Withdrawals from the study were predefined as being due to: adverse events; unwillingness to continue in the trial; major protocol violations, such as non-compliance with treatment for more than 7 consecutive days; and/or the intake of antihypertensive or cholesterol-lowering drugs other than the study drugs.

Treatment and randomization

As stated, eligible patients were randomized into two parallel groups which received either policosanol 20 mg or placebo for 12 weeks.

Both policosanol 20 mg and placebo tablets were manufactured by Laboratorios MedSol (Havana, Cuba). The placebo tablets had similar composition to policosanol tablets, except for the content of the active ingredient, which was replaced by lactose, the inert filler of the formulation. Policosanol and placebo tablets were identical in outer packaging, color, shape, and flavor.

Treatments were randomized by strata, including two groups each (patients with pre-hypertension and patients with grade I hypertension), tablets being assigned by balanced block randomization, with a 1:1 ratio for each stratum, and given to patients according to their consecutive inclusion in the trial.

Treatment compliance

Treatment adherence was assessed by counting tablets and reviewing patient records. Overall, adherence was considered good if > 90% of patients met this criterion.

Concomitant medications

Consumption of antihypertensive and/or lipid-lowering drugs was forbidden, including any drug which could affect such values, such as corticosteroids, except for emergency situations, if these happened.

Study outcomes

The primary efficacy endpoint included changes in the lipid profile. Reductions in LDL cholesterol and total cholesterol, as well as increases in HDL cholesterol, were considered compared to baseline and placebo. For treatment to be effective, final LDL cholesterol levels in the policosanol group had to be significantly lower than baseline and placebo, and ≥ 15% as a net difference from placebo [33].

The significantly reduction SBP and DBP were considered as secondary study outcomes. The study predefined that, to produce a clinically relevant benefit, policosanol should significantly reduce SBP ≥ 10 mmHg compared to baseline [34].

Laboratory variables and analysis

Blood samples were drawn from 8:00 to 8:30a.m. after a 12 hour fast and aliquots were taken for laboratory determinations.

Lipid profile

Serum total cholesterol and triglycerides were determined by colorimetric enzymatic methods using reagent kits from Roche (Switzerland). Serum HDL-C levels were determined according to the cholesterol content present in the supernatant obtained after β-lipoproteins precipitation. LDL-C values were calculated using the Friedewald formula in mmol/L [35].

Other laboratory tests

These tests included determinations of fasting glucose alanine amino transferase (ALAT), aspartate amino transferase (ASAT), creatinine and uric acid. All these were performed by routine laboratory tests based in enzymatic methods using reagent kits from Roche (Switzerland).

All tests were performed in Roche Cobas C311 autoanalyzer (Germany) located at the laboratory of the Surgical Medical Research Centre (Havana City, Cuba).

Systematic quality control was performed throughout the study, so that the precision and accuracy of the methods were followed. Precision was assessed according to repeatability (within-day variations) and reproducibility (between-day variations); while accuracy was evaluated against standard references.

Safety and tolerability

Data from the physical examination, laboratory tests and interview for AE were included for the analysis of treatment safety and tolerability.

Adverse events (AEs) were predefined as any unwanted experience that occurred during the study, regardless of whether they were related to the treatment [36]. Based on their estimated relationship to the study treatment, AEs were also classified as unlikely, doubtful, possibly, or probably related, following the WHO-UMC system [37].

Statistical analysis

Data are presented as mean ± standard deviation of the mean. All data were analyzed on an intention-to-treat (ITT) basis, including data from all randomized patients. Missing data were managed by simple imputation using the carryover method.

ANOVA was used to compare continuous variables throughout the study. Within-group comparisons of these data were performed using the McNemar test once normal distribution was confirmed. Bonferroni adjustment was added for multiple comparisons within a single test [38].

Categorical data were compared using the Chi-square test with Yates correction (Tables 2 × 2).

Data management and statistical analysis were performed at the National Clinical Trials Coordinating Centre (Data Management and Processing Department). SPSS 21.0 was used for the analysis, with EPIDAT 3.1 as a specific auxiliary method.

Sample size estimation

The planned sample size was based on 80% power with a two-sided α level of 0.05 to detect a significant and clinically meaningful reduction in the policosanol groups compared with placebo at week 12. According to GPower version 3.1.19.2 (2014), a total of 400 patients were estimated to be required to complete the study: 200 pre-hypertensive patients (100 treated with policosanol 20 mg, 100 with placebo) and 200 grade I hypertensive patients ((100 treated with policosanol 20 mg, 100 with placebo).

Results

Baseline characteristics

Of 424 patients enrolled in the study, 400 were randomized to receive either policosanol 20 mg (n = 200) or placebo (n = 200), divided in two strata: pre-

hypertensive patients (100 received policosanol 20mg, 100 received placebo) and grade I hypertensive patients (100 in each group also). Twenty-four (24) patients were not included because 23 of these had failed to attend for laboratory testing and one more who had missed the recruitment period deadline.

Table 1 shows the baseline characteristics of the study population, all of which were comparable in both groups (policosanol and placebo). The average age of study patients was about 46 years old, and the frequency of randomized women (74%) was higher than that of men (26%).

The most frequent medications consumed by the whole study population were antihistamines (14 patients, 3.5%) (8 placebo, 6 policosanol), oral hypoglycaemic drugs (10 patients, 2.5%) (6 placebo, 4 policosanol) and analgesics, paracetamol and/or non-steroidal anti-inflammatory drugs (NSAIDs) (8 patients, 2.0%) (4 in each group). The frequency of concomitant medications was statistically similar in both intervention groups.

Study withdrawals

Of 400 randomized patients, 16 (4%) (7 policosanol, 9 placebo) discontinued prematurely the trial (Table 2). The withdrawal rate was similar in both groups. No patient discontinued the trial due to AE.

Efficacy analysis

Compliance with treatment was very good over the study since, apart from the premature dropouts, all other patients consumed the scheduled tablets.

Effects on primary outcome

Table 3 shows the effects on the lipid profile in the study population. After 12 weeks on treatment, policosanol 20 mg/day significantly ($p < 0.05$ versus baseline, $p < 0.001$ versus placebo) decreased LDL-C (15.6%) and ($p < 0.05$ versus baseline, $p < 0.01$ versus placebo), Total cholesterol (8.4%), while significantly increasing HDL-C (6.6%) ($p < 0.05$ versus baseline and placebo).

The net reductions versus those found in the placebo group were 23.6% and 15.8% for LDL-C and total cholesterol, respectively, and the net increase of HDL-C versus placebo was of 7.4%. Curiously, Triglycerides values significantly increased ($p < 0.05$) in both groups as compared to baseline, but no significant differences between both groups were found.

Effects on secondary outcomes

Table 4 summarizes the data of blood pressure measurements over the trial in the whole population. At study completion, policosanol significantly reduced ($p < 0.001$) both SBP and DBP values, as compared to baseline and the placebo group.

Table 1: Baseline characteristics of study patients.

	Policosanol (n = 200)		Placebo (n = 200)		Total (n = 400)	
Age (years) (X ± DE)	46.3 ± 9.3		46.3 ± 8.5		46.3 ± 9.9	
Body mass index (kg/m²) (X ± SD)	26.6 ± 4.6		26.6 ± 4.5		26.6 ± 4.6	
Gender	**n**	**%**	**n**	**%**	**n**	**%**
Women	148	74.0	148	74.0	296	74.0
Men	52	26.0	52	26.0	104	26.0
Pre-hypertensive patients	100	50.0	100	50.0	200	50.0
Patients with grade I hypertension	100	50.0	100	50.0	200	50.0
Personal history						
Overweight (kg/m² ≥ 25, < 30)	74	37.0	74	37.0	148	37.0
Menopause	53	26.5	58	29.0	111	27.8
Sedentary life	42	21.0	51	25.5	93	23.3
Smoking	34	17.0	39	19.5	73	18.3
Obesity (kg/m² ≥ 30)	30	15.0	32	16.0	68	15.5
Salt rich diet	24	12.0	24	12.0	48	12.0
Dyslipidaemia	26	13.0	21	10.5	47	11.8
Diabetes mellitus	10	5.0	7	3.5	17	4.3
Family history						
Hypertension	164	82	161	80.5	325	81.3
Cardiovascular disease	67	33.5	71	35.5	138	34.5
Concomitant drug therapy						
Patients consuming concomitant drug	50	25	48	24	98	24.5
Antihistamines	8	4.0	6	3.0	14	3.5
Oral hypoglycemic	6	3.0	4	2.0	10	2.5
Paracetamol/NSAIDs*	4	2.0	4	2.0	8	2.0

X mean, SD standard deviation, NSAIDs non-steroidal anti-inflammatory drugs

The table includes those concomitant drugs consumed ≥ 4 participants

All comparisons were not significant (ANOVA, $\chi 2$ test)

Table 2: Study withdrawals.

Withdrawal reasons	Policosanol (n = 200)		Placebo (n = 200)	
	n	%	n	%
Unwillingness to follow-up	1	0.5	0	0
Protocol violation	4	2	2	1
Travels abroad	2	1	7	3.5
Total of study withdrawals	**7**	**3.5**	**9**	**4.5**

N number of cases

All comparisons were not-significant (χ2 test)

Protocol violations were due to intake of antihypertensive drugs

Table 3: Effects on lipid profile (X ± SD) in study patients.

Treatment	Baseline	12 weeks	Changes (%)
	Low-density lipoprotein cholesterol (LDL-C) (mmol/L)		
Policosanol	3.02 ± 0.76	2.55 ± 0.72^{*+++}	-15.6^{+++}
Placebo	3.05 ± 0.81	3.26 ± 0.82	+0.8
	Total cholesterol (mmol/L)		
Policosanol	4.40 ± 0.79	4.04 ± 0.78^{*++}	-8.4^{++}
Placebo	4.45 ± 0.90	4.75 ± 0.96	+7.4
	High-density lipoprotein cholesterol (HDL-C) (mmol/L)		
Policosanol	1.21 ± 0.39	1.29 ± 0.32^{*+}	+6.6^{+}
Placebo	1.21 ± 0.39	1.20 ± 0.33	-0.8
	Triglycerides (mmol/L)		
Policosanol	0.89 ± 0.45	1.01 ± 0.57*	+13.4
Placebo	0.93 ± 0.42	1.11 ± 0.60*	+19.4

X mean, SD standard deviation

*p < 0.05 Comparison with baseline (McNemar test)

$^{+}$p < 0.05, $^{++}$p < 0.01, $^{+++}$p<0.001 Comparison with placebo group (ANOVA)

Table 4: Effects on blood pressure values (X ± SD) in study patients.

Treatment	Baseine	4 weeks	8 weeks	12 weeks
	Systolic blood pressure (mm Hg)			
Policosanol	134 ± 9.4	128 ± 10.1	127 ± 11.9	123 ± 9.4^{***+++}
Placebo	134 ± 10.5	131 ± 8.3	131 ± 9.7	133 ± 10.5
	Diastolic blood pressure (mm Hg)			
Policosanol	87 ± 5.3	83 ± 7.1	83 ± 7.7	79 ± 5.7^{***+++}
Placebo	87 ± 5.0	84 ± 5.7	84 ± 6.3	85 ± 5.8

X mean, SD standard deviation

***p < 0.001 Comparison with baseline (McNemar test, Bonferroni´s adjustment)

$^{++}$p < 0.01 $^{+++}$p < 0.001 Comparison with placebo group (ANOVA)

Overall, at study completion, 118/200 policosanol (59%) and 19/200 (9.5%) placebo-treated patients achieved SBP reductions ≥ 10 mmHg compared to baseline, while DBP reductions ≥ 5 mmHg were found in 152/200 policosanol (76%) and 37/200 (18.5%) placebo-treated patients.

Comparisons between groups showed that the frequency of responders was significantly greater in policosanol than in placebo group.

Safety and tolerability

Effects on physical and blood safety indicators: As observed, no significant within or between group differences were found regarding physical safety indicators (bodyweight, body mass index and pulse rate) (Table 5).

Among laboratory variables (Table 6), no significant changes versus placebo were found for any variable. Nevertheless, significant reductions of blood glucose and significant increases of uric acid were found in policosanol and placebo groups. Since these reductions occurred in both groups and individual values were normal, we exclude any clinically relevant meaning of this finding.

Adverse events (AE): Only 12 of 400 patients (3%) (6 policosanol and 6 placebo group) reported some AE (Table not included for simplicity). Nine (9) AE, all transient, were classified as moderate because they required paracetamol for headache (5 patients) or for joint pain (4 patients), these being reported by 6 policosanol and 3 placebo-treated patients. All other AE (polyuria, somnolence, vomiting) were classified as mild, from the placebo group.

All AE were classified, according to the potential causal relation with the treatment, as 'doubtfully related.

Table 5: Effects on physical safety indicators (X ± SD).

Treatment	Baseline	4 weeks	8 weeks	12 weeks
	Bodyweight (kg)			
Policosanol	72.2 ± 14.9	72.1 ± 14.9	72.1 ± 14.9	72.1 ± 14.8
Placebo	72.1 ± 14.6	72.1 ± 14.5	72.1 ± 14.5	72.1 ± 14.3
	Body mass index (kg/m²)			
Policosanol	26.6 ± 4.6	26.6 ± 4.6	26.5 ± 4.6	26.6 ± 4.6
Placebo	26.6 ± 4.5	26.5 ± 4.5	26.5 ± 4.4	26.5 ± 4.1
	Pulse rate (beats/min)			
Policosanol	80 ± 5.7	79 ± 7.5	78 ± 7.1	78 ± 7.0
Placebo	80 ± 6.4	78 ± 7.7	78 ± 7.3	79 ± 6.5

X mean, SD standard deviation

All within (McNemar test) and between (ANOVA) group comparisons were non-significant

Table 6: Effects on blood safety indicators (X ± SD) in study patients.

Treatment	Baseline	12 weeks
	Alanine amino transferase (ALAT) (U/L)	
Policosanol	23.45 ± 8.88	22.35 ± 13.20
Placebo	22.19 ± 9.21	22.00 ± 10.40
	Aspartate amino transferase (ASAT) (U/L)	
Policosanol	24.11 ± 10.84	26.96 ± 15.70
Placebo	24.07 ± 8.62	26.16 ± 11.20
	Glucose (mmol/L)	
Policosanol	5.16 ± 1.52	4.57 ± 1.10*
Placebo	5.04 ± 0.88	4.48 ± 0.70***
	Creatinine (µmol/L)	
Policosanol	73.75 ± 14.94	74.56 ± 15.60
Placebo	73.41 ± 13.90	75.72 ± 14.20
	Uric acid (µmol/L)	
Policosanol	286.83 ± 62.29	327.09 ± 77.80**
Placebo	287.85 ± 62.70	335.43 ± 82.60**

X mean, SD standard deviation

*p < 0.05, **p < 0.01, ***p < 0.001 Comparison with baseline (McNemar test)

Discussion

Baseline characteristics in both groups were similar, demonstrating their homogeneity and confirming that the results were not due to baseline differences between the groups.

The average age in the study was 46 years and there was a higher frequency of women among the study patients. However, the sex distribution was similar in each intervention group.

The study population reflects the coexistence of other cardiovascular risk factors, some related to the patient's lifestyle (sedentary lifestyle, smoking, salt intake), as well as other factors related to these, such as overweight. It should be noted that all the patients included had not previously received antihypertensive treatment.

Sixteen of 400 randomized patients withdrew prematurely from the study, 7 being treated with policosanol, 9 with placebo. So, the discontinuation rate was low (4%), which supports that study conduction was well managed. Indeed, reasons for withdrawals were few and none were associated with AE, which is consistent with the good safety profile of policosanol, as documented.

Policosanol produced beneficial changes in lipid profile variables (primary outcome). After 12 weeks on treatment, significantly decreased LDL-C and total cholesterol while significantly increasing HDL-C versus baseline and placebo, all these changes being favourable for the control of cardiovascular risk.

Regarding the secondary efficacy variable, policosanol produced mean changes in blood pressure values compared to the initial value and placebo, reductions comparable to those reported in studies conducted in Korean and Japanese subjects, despite the fact that these were ethnically homogeneous populations, different from the heterogeneous Cuban population [20-23].

The mechanisms by which policosanol may produce a hypotensive effect have not been fully elucidated. Some studies have found an association between reduced blood pressure and changes in lipid profile variables, as well as a decrease in aldosterone levels, without affecting angiotensin-converting enzyme. Furthermore, its ability to inhibit LDL oxidation (a trigger of endothelial damage) could contribute to its hypotensive effects.

In line with this thought, natural substances with antioxidant effects have been shown to reduce the development of hypertension by diminishing the

damage from oxidative stress on the viability of endothelial cells, which could trigger the subsequent events leading to hypertension [39,40].

In addition, policosanol increases plasma levels of prostacyclin (a vasodilator) and reduces levels of thromboxane 2 (a vasoconstrictor), beneficial effects for reducing endothelial damage, thus preventing one of the events in the chain that leads to high blood pressure.

This post-hoc analysis also corroborates the very good safety of policosanol. No treatment-related impairment of any safety indicator was observed. As expected, treatments were well tolerated by study patients. The frequency of patients referring AE during the trial (12/400, 3%) was low and equal in both policosanol and placebo groups (6 patients reporting AE in each group). AE reported were transient, and apart from those (9) declared as moderate because paracetamol was requested for headache or joint pain, the others were classified as mild.

Conclusions

This post hoc analysis demonstrates that policosanol (20 mg/day) for twelve weeks produced beneficial changes in the lipid profile and was effective in reducing blood pressure in Cuban patients with prehypertension and stage I hypertension. Therefore, policosanol could be considered a possible adjunctive treatment for the management of these patients with low cardiovascular risk.

References

1. Mas R (2000) Policosanol. Drugs of the Future 25: 569-586.
2. Chen JT, Wesley R, Shamburek RD, Frank Pucino, Gyorgy Csako MD (2005) Meta-analysis of natural therapies for hyper-lipidemia: Plant sterols and stanols versus policosanol. Pharmacotherapy 25:171-183.
3. Patrocinio MP, Paranas N, Perez JA, Diana Lynn SQue, Kevin Quiogue, et al. (2015) The effects of sugar cane policosanol on the LDL, HDL, triglyceride and total cholesterol levels of dyslipidemic patients: A meta-analysis. Anesth Med Pract J 117.
4. Gong J, Qin X, Yuan F, Hu M, Guang Chen, et al. (2018) Efficacy and safety of sugarcane policosanol on dyslipidemia: A meta-analysis of randomized controlled trials. Mol Nutr Food Res 62: 170028.
5. Menéndez R, Amor AM, Rodeiro I, González RM, González PC, et al. (2001) Policosa-nol modulates HMGCoA reductase activity in cultured fibroblasts. Arch Med Res 32: 8-12.
6. Singh DK, Li L, Porter TD (2006) Policosanol inhibits cholesterol synthesis in hepatoma cells by activation of AMP-kinases. J Pharmacol Exp Ther 106: 107-144.
7. Oliaro Rosso S, Calcio E, Mantegna S, Enrico Giraudo, Claudia Meda, et al. (2009) Regulation of HMGCoA reductase by policosanol and octacosadienol, a new synthetic analogue of octacosanol. Lipids 44: 907-916.
8. Banerjee S, Ghoshal S, Porter TD (2011) Activation of AMP-kinase by policosanol requires peroxi-somal metabolism. Lipids 46: 311-321.
9. He Feng ying, LU Ji pei, WEI Xiao Min (2015) Effects and mechanism of action of policosanol on decreasing cholesterol in patients with hypercholesterolemia. WCJPS 30: 660-662.
10. Menéndez R, Mas R, Amor AM, Gonzalez R, Fernández JC, et al. (2000) Effects of policosanol treatment on the susceptibility of low-density lipoprotein (LDL) isolated from healthy volunteers to oxidative modification in vitro. Brit J Clin Pharmacol 50: 255-262.
11. Arruzazabala ML, Valdés S, Mas R, Fernández L, Carbajal D (1996) Effect of policosanol successive dose increases on platelet aggregation in healthy volunteers. Pharmacol Res 34: 181-185.
12. Arruzazabala ML, Valdés S, Mas R, Fernández L, Carbajal D (1997) Comparative study of policosanol, aspirin, and the combination of policosanol-aspirin on platelet aggregation in healthy volunteers. Pharmacol Res 36: 293-297.
13. Carbajal D, Arruzazabala ML, Valdés S, Mas R (1998) Effect of policosanol on platelet aggregation and serum levels of arachidonic acid metabolites in healthy volunteers. Prostagl Leukotr Es-sent Fatty Acids 58: 61-64.
14. Arruzazabala ML, Molina V, Mas R, Fernández L, Daisy Carbajal, et al. (2002) Antiplatelet effects of policosanol 20 and 40 mg/d in healthy volunteers and dyslipidemic patients. Clin Exp Pharmacol Physiol 29: 891-897.
15. Xu K, Xinming Liu, Yi Li, Yunuo Wang, Hongyun Zang, et al. (2016) Safety and efficacy of policosanol in patients with high on-treatment platelet reactivity after drug-eluting stent implantation: Two-year follow-up results. Cardiovas Ther 34: 337-342.
16. Sánchez J, Fernández L, Illnait J, Arruzazabala ML, Vivian Molina, et al. (2012) Effects of policosanol on the recovery of ischemic stroke: a randomized controlled study. IOSR Journal of Pharmacy 2: 14-24.
17. Sánchez J, Illnait J, Mas R, Perez Y, Sarahí Mendoza, et al. (2013) Effects of policosanol plus aspirin therapy on the neurological recovery and plasma oxidative markers of patients with ischemic stroke. IOSR Journal of Pharmacy 3: 31-40.
18. Sánchez J, Illnait J, Mas R, Sarahí Mendoza, Hermys Vega, et al. (2016) Policosanol versus atorvastatin in the recovery of the ischemic stroke Int J Pharm Sci Rev 37: 7-14.
19. Sanchez J, Illnait J, Mas R, Mendoza S, Fernandez L, et al. (2017) Long-term effect of policosanol on the func-tional recovery of non-cardioembolic ischemic stroke patients: A one year study. Rev Neurol 64: 153-161.
20. Kim SJ, Dhananjay Yadav, Hye Jeong Park, Jae Ryong Kim, Kyung Hyun Cho (2018) Long-term consumption of cuban policosanol lowers central and brachial blood pressure and improves lipid profile with enhancement of lipoprotein properties in healthy Korean participants. Front Physiol 9: 412.
21. Cho KH, Suk Jeong Kim, Dhananjay Yadav, Jae Yong Kim, Jae Ryong Kim (2018) Consumption of Cuban policosanol improves blood pressure and lipid profile via enhancement of HDL funcionality in healthy women subjects: randomized, double-blinded, and placebo-controlled study. Oxid Med Cell Longev 16: 4809525.

22. Park HJ, Dhananjay Yadav, Da Jeong Jeong, Suk Jeong Kim, Myung Ae Bae, et al. (2019) Short-Term consumption of Cuban policosanol lowers aortic and peripheral blood pressure and ameliorates serum lipid parameters in healthy Korean participants: ran-domized, double-blinded, and placebo-controlled study. Int J Environ Res Public Health 16: 809.

23. Nam HS, Baek SH, Kang DJ, Na H, Komatsu T, et al. (2023) Beneficial effect of Cuban policosanol on blood pressure and serum lipoproteins accompanied with lowered glycated haemoglobin and enhanced High-Density Lipoprotein functionalities in a randomized, place-bo-controlled, and double-blinded trial with healthy Japanese. Int J Mol Sci 24: 5185.

24. Askarpoura M, Ghaediab E, Roshanravanc N, Hadid A, Mohammadif H, et al. (2019) Policosanol supplementation significantly improves blood pressure among adults: A systematic review and meta-analysis of randomized controlled trials. Complemen-tary Therapies in Medicine 45: 89-97.

25. Fernández L, Mas R, Illnait J, et al. (1998) Policosanol: Results of a post-marketing surveillance control on 27 879 cases. Curr Ther Res 59: 717-722.

26. Mas R, Rivas P, Izquierdo JE, Reynaldo Hernandez, Lilia Fernández, et al. (1999) Pharmacoepidemiologic study of policosanol. Curr Ther Res 60: 458-467.

27. Fernández S, Mas R, Gamez R, Arquímedes Diaz, Julio Fernández, et al. (2004) Pharmacological surveillance of policosanol tolerability in the elderly. Am J Ger Pharmacotherapy 2: 219-229.

28. Flint AC, Conell C, Ren X, Banki NM, Chan SL, et al. (2019) Effect of systolic and diastolic blood pressure on cardiovascular outcomes. N Engl J Med 381: 243-251.

29. NCD Risk Factor Collaboration (2017) Worldwide trends in blood pressure from 1975 to 2015: A pooled analysis of 1479 population-based measurement studies with 19.1 million participants. Lancet 389: 37-55.

30. Carey RM, Moran AE, Whelton PK (2022) Treatment of hypertension: A Review. JAMA 328: 1849-1861.

31. Brunstrom M, Carlberg B (2018) Association of blood pressure lowering with mortality and cardio-vascular disease across blood pressure levels: A systematic review and meta-analysis. JAMA Intern Med 178: 28-36.

32. World Medical Association (2013) World medical association declaration of helsinki- ethical principles for medical research involving human subjects. JAMA 310: 2191-2194.

33. Schectman G, Hiatt J (1996) Drug therapy for hypercholesterolemia in patients with cardiovascular disease: Factors limiting achievement of lipid goals. Am J Med 100: 197-204.

34. Bundy JD, Li C, Stuchlik P, Bu X, Kelly TN, et al. (2017) Systolic blood pressure reduction and risk of cardiovascular disease and mortality: A sys-tematic review and network meta-analysis. JAMA Cardiol 2: 775-781.

35. Friedewald WT, Levy RI, Friederickson SD (1972) Estimation of the concentration of low-density lipoprotein cholesterol in plasma without of the preparative ultracentrifuge. Clin Chem 18: 499-502.

36. (2007) NIA adverse event and serious adverse event guidelines.

37. WHO (2013) The use of the WHO-UMC system for standardised case causality assessment. 3.

38. O'Brien PC, Shampo MA (1988) Statistical considerations for performing multiple tests in a single experiment. Comparing two therapies with respect to several endpoints. Mayo Clin Proc 63: 1140-1143.

39. Butnariu M, Fratantonio D, Herrera Bravo J, Sukreet S, Martorell M, et al. (2023) Plant-food-derived bioactives in managing hypertension: From current findings to up-coming effective pharmacotherapies. J Curr Top Med Chem 23: 589-617.

40. Caminiti R, Carresi C, Mollace R, Macrì R, Scarano F, et al. (2024) The potential effect of natural antioxidants on endothelial dysfunction is associated with arterial hypertension. Front Cardiovasc Med 11:1345218.