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Consumption of *Ananas comosus*' Juice Fruit and Aerobic Exercise Practice Both Effects on Blood Lipid Parameters of Yaounde's Obese Women (Cameroon)

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ABSTRACT

Ananas comosus (L.) Merr. (Bromilaceae), is a fruit wordly consumed. The present study is to evaluate the effects of raw juice of Ananas comosus and aerobic exercise on blood biochemical parameters in obese women. Thirty obese women took part in the experiment for 45 days and were divided randomly in 3 groups of 10 women. Group1 (G_1) consumed daily 1,26 L of crude pineapple juice. Group 2 (G_2) practiced an aerobic exercises. Group 3 (G_3) consumed the pineapple juice and practiced aerobic exercise according to the protocol of G1 and G2. Biochemical, hemodynamic and anthropometric parameters were measured at the beginning and end of the study. The results showed that total cholesterol (TC) and Low Density Lipoprotein cholesterol (LDL-c) decreased significantly in all the 3 proups. Triglycerides have only decreased in G_2. The AI and Blood Sugar were significantly low in all three groups. SBP, Rest Cardiac Frequency (RCF) and the weight have decreased only in G_3. In conclusion, Ananas comosus raw juice and aerobic exercise have had individually positive effects on the variables studied. In addition, changes in these variables are pronounced in G_3 through the associated action of the two treatments.

Keywords: Cardiovascular disease; Pineapple raw juice; Aerobic exercise; Obese women

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INTRODUCTION

Cardiovascular diseases (CVD) are sort of affections that attack the heart and blood circulation. They are characterized by the damage caused to blood vessels in the body organism, particularly the coronary arteries, the carotid arteries that supply blood and lower limbs [1]. They are considered by the World Health Organization as a major cause of premature death and disability worldwide and in 2005, these diseases have caused 30% of the 58 million deaths and topped the list of most frequent causes of death [2]. Some forecasts WHO estimated that in 2010 , CVD could become a major cause of deteriorating health in the world.
In South-East Asia and Latin America, CVD current mortality is about 20%. The increasing prevalence of CVD morbidity and mortality (> 20%) have become a major public health problem in sub-Saharan Africa especially with the increase of atherosclerosis [3]. CVD is the cause of 10 to 40 million death annually in developing countries, while they were rare some decade ago [2].

In Cameroon, CVD constitute a large field of several diseases. Among the best known, there is high blood pressure in urban erea. The rate of population suffering is 12% and the estimation of population at risk can reach 40% [4]. The increase is due to the new people life conditions and some risk factors as smoking, obesity, stress, diabetes, physical inactivity and high blood cholesterol. In addition, cholesterol is also a risk factor for heart disease, stroke and arteriosclerosis. If smoking, physical inactivity, stress, diabetes are added to hypertension or cholesterol obesity, risk of heart disease increases and more severely compromises human health [4]. In light of these multiple disorders, cardiovascular disease has become a public health problem in Cameroon so the need to prevent or treat [4]. Management of CVD is multidisciplinary. In addition to medical care, it is recommended that people consume the unsaturated fat contained in the fruit, vegetable fiber and physical activities of moderate intensity to reduce blood high cholesterol [5].

Fresh vegetables and fruits like pineapple have for long time been known for their protective effect toward cardiovascular disease. They have the advantage of containing high quantitie of specific dietary fiber, which limits the uptake of cholesterol in the organism. The dietary fiber are necessary for body health maintenance. Indeed, a high fiber intake is associated with a low incidence of cardiovascular disease, obesity and diabetes of type 2 in a population [6]. Use in traditional medicine in Cameroon to treat high cholesterol, obesity and has diuretic activity, *Ananas comosus* has become a powerful remedy with its high contents of bromelain. Bromelain is an enzyme which would occur in the lipolysis and hence would prevent and minimize the severity of pectoris angina and ischemic attacks. It can be used at doses ranging from 300 to 5000 mg per day [7]. It fluidifies the blood and helps to dissolve atherom plaque by attacking strongly the deposited fat which clutt veins [8].

CVD has been the subject of several studies on their supported by physical activities. It should be noted that the pratic of physical activity is associated with a reduction of cardiovascular disease risk factor. It has been reported that exercise reduces the accumulation of visceral adipose tissue in obese animals and humans [9], decreases blood pressure [10], improves lipid profile [11]. In the light of all these observations, the present work proposes precisely to study the cumulative effects of raw pineapple juice and aerobic exercise on blood biochemical parameters.

EXPERIMENTAL SECTION

Materials

Rootstock:

Ananas comosus Smooth Cayenne variety fruits, bought at Yaounde's Mfoundi market was used to produce the raw juice. The plant was identified at the Yaounde National Herbarium, where each specimen was preserved in the sample N° 18648/SRF/CAM.

Subjects:

Thirty (30) obese women, sedentary volunteers, residing in Yaounde's city, aged between 25 and 62 old year, took part in the study. After the diagnostic evaluation of anthropometric, biochemical and hemodynamic parameters, subjects were randomized into three homogeneous groups of 10 women each.

Methods

Obtaining pineapple raw juice:

The juice was obtained after sorting, washing and peeling the fruits of *Ananas comosus*, the rest was cuted, crushed and filtred. The obtained liquid is kept in aseptic packaging and refrigerated at 4 °C before utilization.

Experimental groups composition and women preparation:

The experimental protocols have been approved by the Young and Sport National Institut of Yaounde Ethical Committee and was confirmed by the one of Medecin and Biomedical Sciences Faculty of Yaoundé I University G1 subjects consumed daily amount of 1.260 L of pineapple juice, taken two at most one hour before a meal and 8 hours later after manufacture. G2 subjects performed aerobic exercises, 04 sessions per week for a period which varies from 45 to 90 min with an intensity find between 50 and 70% of maximum heart rate, average of walking and/or jogging speed of 5 km/h with SBP sive or active and strengthening exercises recoveries. Load, duration and intensity gradually inrease from the beginning to the end of the training program, to induce maximum efficiency of aerobic exercises. G3 women followed both protocols applied to G1 and G2.

Measurement of anthropometric parameters

After the introduction of age and sex, the subject climb on the bioelectrical scale (BF 136/BF 136 ED mark), the numerical values of the weight and percentage of fat were read on the screen. The weight is measured using a stadiometer. Body Mass Indice (BMI) was calculated by the following formula : weight (kg)/(height (m))^2.

Measurement of hemodynamic parameters

The electric monitor, bloof pressure apparatus (Scala Sc. 5100 Germany mark) was placed on the wrist of the left arm of the subject. After 30 minutes of resting, the values of Systolic Body Pressure (SBP), Diastolic Body Pressure (DBP) and RCF (deteminate with Polar RS800CX, Kempele, Finlande mark apparatus) were read directly on the face of the monitor.

Determination of blood biochemical parameters

The venous blood collected in haemolysis plastic tubes was used for the dosage of lipid parameters. The triglycerides (Trigl) were examined by a method [12] based on enzymatique method principle of hydrolysis of serum triglycerides by lipase lipoprotein to glycerol and fatty acid. The intensity of the color is proportional to the amount of triglycerides present in the serum. Optical density (OD) of standard and assay were performed with a spectrophotometer (CYAN Start mark) after 10 minutes of incubation at 25 ± 2 °C. The density values were used to calculate the concentration of triglyceride. Triglycerides = (DO mixture/DO standard) x n (n = 2 g/L or 2, 28 mmol/L). The total cholesterol (TC) was measured by an enzymatic method whose principle is based on the hydrolysis of the cholesterol ester content in the blood serum by cholesterol esterase to fatty acids and cholesterol. Spectrophotometer readings after 10 minutes of incubation at 25 ± 2 °C have achieved the standard OD and the OD of the assay, which were used to calculate the rate of total cholesterol. Total cholesterol = (OD dosage/standard OD) xn (n = 2 g/L or 5.17 mmol/L). The determination of HDL cholesterol is carried out with the reagents of the Cholesterol after centrifugation and formation of clear orange color of the blood. The enzymatic absorbance was read in a spectrophotometer, against a blank in which the supernatant was replaced by the distilled water. The calculation of the concentration of HDL-cholesterol was carried from the densities obtained : HDL cholesterol ratio = (OD dosage/standard OD) x n (n = 0.5 g/L) The LDL cholesterol levels is obtained by the formula [13]. LDLc (g/L) = CT (g/L) – HDLc (g/L) – 1/5 Trigl (g/L) The blood glucose is obtained by taking a blood drop at the finger and placed on the test area of the glucometer (Accu-Chek® Active mark). The blood glucose level (mg/dL) is displayed on 05 seconds and then converted into g/L.

Statistical treatment

For each group of subjects characteristics of central tendency were calculated : mean (x), standard deviation (s) etc. The differences between means were tested by the Student test on paired samples for all groups. Variations in average percentage were allowed to know which treatment is more effective than others. Statistical processing is performed using the Statistica 5.5 software. Differences are significant at $p < 0.05$.

RESULTS AND DISCUSSION

Results

Effects of pineapple juice and aerobic exercise on lipid parameters

The mean values of lipid parameters are shown in table I. After 45 days of consumption of Pineapple juice and doing the sports, the TC rate declined high significantly ($p < 0.001$) in G3 (23.82%). Similarly, LDL-c levels decreased significantly in G1 (30.53%), G2 (30.24%) and highly significant ($p < 0.01$) in G3 (44.18%). HDL-c increased slightly from 14.04% in G1 and G2. index atherogenic (R.CT/HDL-c) decreased very significantly in G1 (35.05%) and the decrease was significant in G2 (34.59%); G3 (22.51%)..

Table 1: Mean values of lipid parameters at the beginning and the end in G_1, G_2 and G_3

Lipid Parameters	Group 1			Group 2			Group 3		
	Start	End	Δ (%)	Start	End	Δ (%)	Start	End	Δ (%)
C-T (g/l)	2.42 ± 0.40	2.04 ± 0.36	-15.70*	2.35 ± 0.52	1.92 ± 0.45	-18.29*	2.35 ± 0.34	1.79 ± 0.28	-23.82***
HDL-C (g/l)	0.55 ± 0.07	0.63 ± 0.02	14.04	0.57 ± 0.08	0.65 ± 0.15	14.04	0.62 ± 0.07	0.60 ± 0,14	-3.22
LDL-C (g/l)	1.67 ± 0.42	1.16 ± 0.41	-30.53*	1.62 ± 0.52	1.13 ± 0.41	-30.24*	1.72 ± 0.42	0.96 ± 0.33	-44.18**
Trgl (g/l)	0.97 ± 0.57	0.65 ± 0.07	-32.98	0.92 ± 0.35	0.69 ± 0.14	-25.00*	0.99 ± 0.55	0.69 ± 0.14	-30.3
R.C-T/C-HDL	4.45 ± 0.96	2.89 ± 0.83	-35.05**	4.22 ± 1.04	2.76 ± 1.10	-34.59*	4.00 ± 1.06	3.10 ± 0.73	-22.51*

C-T : total cholesterol, HDL-C : HDL-cholesterol, LDL-C : LDL-cholesterol, TRGL : triglycerides,* : Significant ($p < 0.05$), ** : significant ($p < 0.01$), *** : significant ($p < 0.001$), Δ (%) : variation; mean ± sem (average standard error).

Effects of pineapple juice and aerobic exercise on glycemy

Glucose (table II) was very significantly low ($p < 0.01$) in G1 (25.89%), whereas this was significant in G2 (15.17%) and G3 (17.6%).

Table 2: Mean values of blood sugar at the beginning and the end in G1, G2 and G3

	Group 1			Group 2			Group 3		
	Start	End	Δ (%)	Start	End	Δ (%)	Start	End	Δ (%)
Glucose	1.39 ± 0.36	1.03 ± 0.10	-25.89**	1.12 ± 0.26	0.95 ± 0.09	-15.17*	1.25 ± 0.28	1.03 ± 0.15	-17.60*

Δ (%) = change; * P <0.05; * P <0.01; mean ± s e m (average standard error)

Effects of pineapple juice and aerobic exercise on hemodynamic parameters

Table III shows that the SBP has a significant decrease only in group 3. In addition, the diminition of DBP was not significant in all three groups. As for RCF, its decline is significant in G_1 (8.56%) and G_2 (8.56%).

Table 3: Mean values of hemodynamic parameters at the beginning and the end of the experiment in G1; G2; G3

Parameters Hemodynamic	Group 1			Group 2			Group 3		
	Start	End	Δ (%)	Start	End	Δ (%)	Start	End	Δ (%)
SBP (mm Hg)	13.10 ± 1.79	13.20 ± 1.61	76	14.10 ± 1.19	13.30 ± 1.70	-5.67	13.6 ± 1.83	12.7 ± 1.70	-6.61*
DBP (mm Hg)	8.80 ± 1.03	8.80 ± 1.54	0	9.10 ± 1.85	8.50 ± 1.17	-6.59	8.60 ± 1.15	8.50 ± 1.50	-1.16
RCF	76.60 ± 1.36	74.20 ± 12.11	-3.13	80.6 ± 11.50	73.70 ± 9.66	-8.56*	80.60 ± 11.5	73.70 ± 9.66	-8.56*

Δ (%) = change, SBP = systolis body pressure, DBP = distolis body pressure, RCF = resting heart rate, mean ± s e m (average standard error), * p<0.05

Effects of pineapple juice and aerobic exercise on anthropométric parameters

In Table IV, containing the average values of anthropometric parameters, we observe that the weight has been significantly decrease ($p < 0.05$) in G3 (1.48%). The decrease in BMI and% BF that are not significant in G1, G2 and G3.

Table 4: Mean values of anthropometric parameters at the beginning and the end of the experiment in the three groups of subjects

Setting Anthropometric	Group 1			Group 2			Group 3		
	Start	End	Δ (%)	Start	End	Δ (%)	Start	End	Δ (%)
Weight (Kg)	91.78 ± 11.83	92.44 ± 12.29	0.82	90.89 ± 13.21	90.14 ±13.04	-0.82	94.25 ± 16.30	92.85 ± 15.45	-1.48*
BMI (Kg/m2)	33.46 ± 4.50	33.51 ± 4.45	0.14	33.46 ± 4.80	32.52 ± 4.19	-2.8	34.10 ± 4.80	33.98 ± 6.90	-35
Body fat (%)	42.55 ± 5.02	42.55 ± 4.43	0	42.85 ± 5.72	43.61 ± 5.97	1.77	41.99 ± 6.24	41.87 ± 7.01	-0.28

Δ (%) = change; BMI = body mass index; * P <0.05; mean ± s e m (average standard error).

Discussion

Lipid parameters

The results of lipid parameters in G_1, such as rates of CT, LDL-c, $R_{CT/HDL-C}$ declined significantly. Atherogenic risk factor that has decreased in this group is explained by a lower rate of CT and a slight increase of HDL-c. The average value of $R_{TC/HDL-C}$ less than 3, indicat that subjects in the G1 have a low risk of developing coronary heart disease. This result can be explained by the consumption of raw pineapple juice containing bromelain [8, 14]. In addition, the juice contained dietary fiber could have a hypocholesterolemic effect by increasing the fecal excretion of bile acids and thus decreasing the enterohepatic circulation of bile acids. This leads to a decreasing of hepatic cholesterol, a growth of the endogenous cholesterol synthesis and an increase of the synthesis of LDL-c receptors, causing their uptake and their lowering [6]. Our results showed a significant decrease of triglycerides of 32.98% even though it was not significant. The decrease of triglyceride levels could be explained by the presence of a nother constituants in a juice and the slow action of bromelain on fat, because at the intersection of collagen fibers that are trapped fats to facilitate their degradation, although clinical studies on man missing for confirmation [15].

The level of atherogenic risk at the begining of the training was critical in G2, with the average of $R_{CT/HDL-C}$ of 4.22 ± 1.04. This group 2 showed 34.59% AI risk. But at the end of the experiment the ratio improved of 2.76 ± 1.10 on average. The significant decrease ($p < 0.05$) in this report is due to the decreased levels of TC, LDL-c, and also a slight increase in HDL-c. As well as in G1, this result shows that the G2 subjects also have a low risk to developing the coronarian disease at the end of the study. Indeed, the $R_{CT/HDL-C}$ constitue probably the best index of the coronary heart disease risk. When its value is beyond 5 the risk is major and below 3 the risk is low. Several authors have shown that regular physical exercise reduces atherogenic risk [16-18]. In addition, it is noted that the rate of triglycerides decreased significantly by 25% at the end of the training program in group G2 subjects compared to the G1. This result confirms the results of those authors who have shown that physical exercise reduces the accumulation of visceral adipose tissue in obese animals and humans [9] and improves the lipid profile [13]. In observing these results, aerobic exercise program of which subjects were bound, would have reduced the rate of CT, LDL-C, triglycerides and slightly increases the HDL-c as observed by the authors foregoing.

The combination of pineapple juice consumption and aerobic exercises practice in G_3 had remarkable effects on the variables studied. Thus, the analysis of results obtained in G_3, revealed a very shighly significant decrease ($p < 0.001$) of TC (23.82%), LDL-c (44.18%) and $R_{CT/HDL-C}$ (22.51%). These results confirmed the previous works which have shown that on patients with overweight, physical exercise associated with the consumption of fruit low in cholesterol and high in dietary fiber, lead to an increasing of HDL cholesterol, a lowering of TC and LDL-c [5, 13]. It appears through these results that both treatments had synergistic effects on the studied parameters. It should be noted that the non-significant decrease in triglyceride levels and slight increase in HDL-c during the study can be explained by the short duration of treatment [18].

The decrease in the level of atherogenic risk observed in the three groups has shown the effects of treatment on lipid parameters. These were more pronounced in G3 compared to G1 and G2.

Glycemic parameters

Glucose decreased significantly in G_1, G_2 and G_3 subjects. This result can be explained on one hand (G_1) by the presence of vitamin B1 in pineapple that helps body to convert carbohydrates and to consume calories [19] and other (G2), by physical training which improves in generaly glucose homeostasis and limiting the risk of hypoglycemia [20]. Moreover, in G3, this drop in blood sugar can be explained by the combined effect of the consumption of pineapple juice and its association with the aerobic exercise practice.

Hemodynamic parameters

In G_1 any hemodynamic parameter has not significantly declined. This suggests that consumption of pineapple juice did not alter blood pressure values.

By cons in G_2 subjects, RCF decreased significantly, and SBP and DBP showed a significant decrease respectively 5.67% and 6.59% compared to the G_1. The non-significant decrease of SBP and DBP can be explained by the short duration of the experiment. Because some previous results have shown that the purpose of the physical exercise practice is to reduce blood pressure values by regular stimulation of the nervous system. This is especially true for endurance activities for two to three months during which a drop of resting blood pressure is observed [21, 22]. As for G3 subjects, their SBP et RCF have declined significantly compared to G1 and G2. This result can be explained by the synergistic effect of the two treatments.

Anthropometric parameters

Analysis of the results of anthropometric parameters showed a slight increase in the average weight in G_1 compared to the expected decline. These results indicate that consumption of pineapple juice did not induce weight loss. Our results were close to the work of some authors who have shown that bromelaïne unfortunately carries any actions on fat, as suggested by numerous commercials. Bromelain surcharge could facilitate digestion in some people, but its effectiveness is still uncertain. As weight loss result of an expense of energy greater than that ingested, this is not the consumption of pineapple or bromelain which leads to lose weight, but calorie restriction that accompanies several plans [7]. In G_2 the average weight of the subjects experienced a slight decline. If the weight decreased slightly in this group, this can be explained by the fact that aerobic endurance training, which in some measures, increases protein synthesis, muscle fiber density and stimulates bone formation [23, 24]. On addition, the slight decrease in the weight and the BMI, appear also be related to the very short duration of the experiment [21].

Compared to G_1 and G_2 subjects, those of G_3 are presented a significant decrease of weight (1.48%). This weight reduction is noticed in this group by a slight decrease of BMI and percentage of body fat . This finding may reflect the cumulative effect of two traitements. This synergy between the consumption of pineapple raw juice and physics training can be explained at several levels. Muscular exercise acts by reducing appetite [24] and the consumption of pineapple raw juice during the period of the experiment reduce the daily amount of food taking by obese subjects [7]. For this purpose the additional energy expenditure is not offset by an increase in contributions.

CONCLUSION

The aim os this studiy was to verify the effect of consumption of raw pineapple juice and the practice of aerobic exercise on blood biochemical parameters in 30 obese women. The results indicated that the daily consumption of raw juice of *Ananas comusus* and the practice of aerobic exercise have favorably altered the studied parameters. That TC rates, LDL-c, $R_{CT/HDL-c}$ and glucose decreased significantly in all experimental groups. In addition, weight and SBP decreased significantly in G_3. And also RCF experienced a significant decrease in G_2 and G_3. To conclude we can say that the consumption of pineapple raw juice contains bromelain associated with regular aerobic exercise has more effect on blood's biochemical parameters.

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