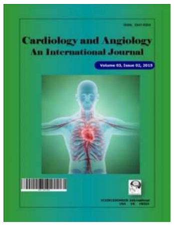

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About Physical Bases of Heart Acting. Case of Healthy Women in Democratic Republic of Congo

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Authors' contributions

The first author is the designer (head of conception) and writer of this paper. He is the chairman of the laboratory (LACOPA). The second author is the experimentalist of the results of this paper and he is the PHD student in the laboratory (LACOPA). He has done the references. The two last authors have helped in the reading of the manuscript. All authors read and approved the final manuscript.

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ABSTRACT

Background: The hypertension is probably the most important public health problem in our country. It is readily detectable and often leads to lethal complications such as heart failure if left untreated. Indeed among the multiple causes of the heart failure, the severe arterial hypertension can be quoted. It is known for example that the lengthy arterial hypertension entails concentric left ventricular hypertrophy, with the decrease of the compliance and a diastolic dysfunction; it can also entail a decrease of the systolic function due to an interstitial fibrosis or to the happening of a myocardic infarctus, and volumic overcharge can finally occur because of the left ventricle supplementary dilation and because of the apparition of a functional mitral failure.

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Aim and Objective: Tremendous endeavors have been undertaken to find a global intensive physical parameter that will give quantitative scientific informations on both the healthy state and the hypertension state of the heart from the usual parameters (systolic and diastolic pressures, cardiac frequency).

Methodology: The experiments have been carried out upon one thousand healthy women of Kinshasa (Democratic Republic of Congo) through different ages (years) from November to August 2015 at University of Kinshasa (DRC). The blood pressure measurements and calculations are our methodology of work.

Results: In this paper Kunyima equation, from compartmental analysis, has been proposed and in this equation the volumic cardiac power has been dialed and successfully correlated to P_D, factor characterizing the artery state. The cardiac frequency has been found to be the kinetic constant of blood circulation.

Conclusion: The volumic cardiac power expressed in Kunyima equation has been a global intensive physical parameters of cardiac frequency and differential pressure. It has been more advantageous and more expressive than the usual parameters. Our burning desire has been to see this parameter on the future sphygmomanometers screen.

Keywords: Kunyima equation; differential pressure; volumic cardiac power; kinetic constant; cardiac frequency.

ABBREVIATIONS

Blood pressure (P_b); Concentration (C); P_C (cardiac power); P_V (volumic cardiac power); k_k(kinetic constant in small circulation); Differential pressure (P_D); Cardiac frequency (f_C); Systolic pressure (P_S); Diastolic pressure (P_d).

1. INTRODUCTION

The cardiac cycle is marked by the sound phenomena, called noises which are normally audibles by simple auscultation. Those noises are the consequence of the alternation of diastolic periods (periods of rest) and of systolic periods (periods of contraction) [1,2,3,4].

The heart, a pump, natural dipole, an engine that is never tired at normal state, can be considered as a natural thermodynamic system filling up functions of a pump assigned to collect the venous blood and to distribute it then, in a continuous way, at the set of the organism after oxygenation in the lungs (alveoli). The right auricle recovers venous blood of the general circulation by means of the vena cava. This blood is ejected in the right ventricle that expels it after contraction in the pulmonary artery before joining the lungs. During the diastole, the left ventricle communicates with the left auricle, the mitral orifice being opened: the blood passes from the auricle to the ventricle, the pressure being lower in this last [5,6,7].

At the end of the diastole, the auricle contracts itself to finish the ventricular replenishment. The pressure of the ventricle blood is then higher than in the auricle and the mitral valves close. During all the diastole, the left ventricle is isolated from the aorta by the efficient closing of sigmoid valves at the origin of this artery. The systole is marked by the expulsion of the blood from the left ventricle to the aorta [8,9,10].

Indeed swiftly beneath the effect of myocardic contraction, the blood pressure in ventricle increases considerably. When it becomes higher than the aorta pressure the blood is ejected out of the ventricle. Sigmoid valves will close only when aortic pressure will become higher than the pressure in the left ventricle. After this shutting intraventricular pressure decreases considerably and when it becomes lower than the one in the left auricle, the mitral orifice opens and the cycle restarts. The left ventricle contains at the end of diastole about 150 ml of blood whose 80 ml only are ejected during the systole [2,11,12].

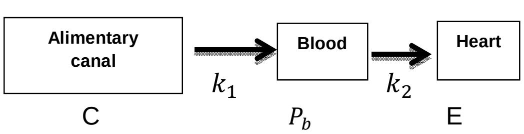
Things are the same with the right ventricle. At each minute, the right ventricle expels in the pulmonary circulation the same quantity of blood than the quantity expelled in the same time by the left ventricle in the aorta: the blood debit of the right heart is equal to the blood debit of the left heart. Tremendous endeavors have been undertaken to find a global intensive physical parameter that will give quantitative scientific informations on both the hypertension state of the engine (heart) with its consequences and the healthy state from the measurable existent parameters such as systolic pressure, diastolic pressure, cardiac frequency. Hence a mathematical model has been conceived, tested on healthy women and proposed.

It has been realized that the ejection of the blood in the left ventricular contraction to aorta is the result of the differential pressure (P_D) and the heart working as an engine should have a cardiac power that can be expressed and dialed by means of the measurable existent parameters such as cardiac frequency and differential pressure of the blood in the small circulation. Among the factors that can allow to determine the heart condition, the cardiac power can be more expressive.

So Kunyima equation has been deduced from compartmental analysis [13,14] performed through a simple pattern of three compartments such as alimentary canal, general circulation blood and small circulation blood (heart). It consists to imagine the introduction in the alimentary canal of a substance of C concentration (quinine for example).

This material has certainly an influence on blood pressure (P_b) in general circulation and its passage in this milieu (active transfer) is characterized by a kinetic constant (k_1) which is a rate constant determining the kinetic state of the event. Its introduction in the small circulation has a kinetic constant k_2 different from k_1 and modify extensively the energetic contribution [15,16,17,18] of the cardiac system (E). These considerations lead to establish Kunyima equation, very prominent and useful, which is the fundamental of this paper as it is hereby shown.

Indeed taking into account the three above mentioned compartments different equations can be written



For this system the following relations can be logically written

$$\begin{cases} \dot{C} = -k_1 C & (1) \\ \dot{P}_b = k_1 C - k_2 P_b & (2) \\ \dot{E} = k_2 P_b & (3) \end{cases} \quad \text{With} \begin{cases} \dot{\boldsymbol{C}} = \frac{d\boldsymbol{C}}{d\boldsymbol{t}} \\ \dot{\boldsymbol{P}}_{\boldsymbol{b}} = \frac{d\boldsymbol{P}_{\boldsymbol{b}}}{d\boldsymbol{t}} \\ \dot{\boldsymbol{E}} = \frac{d\boldsymbol{E}}{d\boldsymbol{T}} \end{cases}$$

It can be imagined that at initial time (t=0), C=C_0, $P_b = P_b^0$ and E= E_0. The initial energetic (E_0) contribution of the heart can be neglected after. When the disturbance effect of k_1 on the state variables C, P_b, E is pointed out in differentiating the above-mentioned equations by k_1 the following equations can be obtained.

(1) $\frac{\partial^2 C}{\partial t\, \partial k_1} = -k_1 \frac{\partial C}{\partial k_1} - C$

(2) $\frac{\partial^2 P_b}{\partial t\, \partial k_1} = k_1 \frac{\partial C}{\partial k_1} + C - k_2 \frac{\partial P_b}{\partial k_1}$

(3) $\frac{\partial^2 E}{\partial t\, \partial k_1} = k_2 \frac{\partial P_b}{\partial k_2} \Rightarrow \frac{\partial}{\partial k_1} \frac{\partial E}{\partial t} = \frac{\partial \dot{E}}{\partial k_1} = k_2 \frac{\partial P_b}{\partial k_1}$

(3) $\Rightarrow \int \partial \dot{E} = \int k_2 \partial P_b$

$\dot{E}$ = $k_2 P_b$ (integration constants are neglected).

$$\frac{dE}{dt} = k_2 P_b$$

$$\int dE = \int k_2 P_b \, dt$$

For k_2 and P_b constants

E=$k_2 P_b$t $\Rightarrow \frac{E}{t} = k_2 P_b$ =P=power

P = $k_2 \, P_b$

The blood flow power in general circulation, neglecting the integration constants, is in first approximation directly proportional to blood pressure (P_b) which is in fact the variation of pressure (active transfer). This equation imposes that the blood power should be reduced to volumic power ($P_V = \frac{P}{V}$) in order to have accurate unit of k_2. Hence it can be written

$$P_V = k_2 \, P_b$$

This relation has been called Kunyima equation to note the name of Dr. KUNYIMA BADIBANGA, Ordinary Professor at University of Kinshasa in Democratic Republic of Congo (DRC) who proposed it. As the cardiac acting is submitted to a cycle of systolic and diastolic periods, Kunyima equation in small circulation will be written as follows

$$P_V = k_k \, P_D$$

Where:

P_D= differential pressure = $P_S - P_d$; P_S= systolic pressure; P_d = diastolic pressure; k_k = kinetic constant in small circulation; P_V= volumic cardiac power.

P_D, for a certain age person or a certain age group and in absence of all kind of disturbance (stress, shell shock, presence of foreign substances in blood circulation, and so forth) is practically constant and the present paper takes into account this assertion. In this case effectively it is noteworthy to point out the analogy between Kunyima equation in small circulation and the equation in the reference [2,13] giving the cardiac power when 80 ml of blood are ejected in left ventricular contraction beneath the differential pressure.

Note that at each contraction about 80 ml of blood are ejected [11,16]. It is known that affections such as arteriosclerosis, coarctation of aorta, stenosis of kidney artery breed the important increase of P_D. In this case however P_D and P_b are not any more constant, they depend on time and Kunyima equation becomes an homogenous differential equation of the first degree with second term which can be solved as usually.

$$\frac{dP_b}{dt} + k_2 P_b = k_1 C \text{ With C = } C_0 e^{-k_1 t}$$

$$\text{Homogenous solution} = \mathbf{y_h} = \mathbf{P_b} = \mathbf{P_b^0 e^{-k_2 t}}$$

Particular solution = y_p

$$y_P = P_b = P_b^o e^{-k_2 t} + \frac{k_1 C_O}{k_2 - k_1} (e^{-k_1 t} - e^{-k_2 t})$$

The corresponding energy is

$$\boldsymbol{E} = \left(\frac{k_1 C_0}{k_2 - k_1} - 2\, P_b^0\right) e^{-k_2 t} - \frac{k_2 C_0}{k_2 - k_1} e^{-k_1 t} + F_0$$

F_0 can be conventionally taken equal to zero.

Also it can be demonstrated that when P_b is constant

$$\text{E} = C_0(1 - e^{-k_1 t}) + E_0$$

$E_0 = 0$ for the same above-mentioned reason. As it can be seen the measure of P_b constant or not allows to determine $\boldsymbol{k_1}$, k_2 and to get as well qualitative as quantitative important informations of the evolution with time of a substance displacement in blood flow.

2. MATERIALS AND METHODS

The study has been performed on one thousand healthy women whose age varies from 20-80 years between November 2014 - August 2015. The sphygmomanometer (Manuel, type Aneroid 767 Tycos mural de Welch Allyn) has been used to measure the blood pressure [19,20]. An ad-hoc checking form has been distributed to each woman to collect the data such as blood pressure, cardiac frequency, weight, size, age, sex, temperature, basic food. The observation and calculations [14,21] are our methodology of work. The figures have been plotted by means of origin 6.1 program. The important parameters such as blood pressure, cardiac frequency, age, have been privileged to verify the validity of Kunyima equation. Temperature has been the parameter showing the absence of fever. The basic food, size, weight,… have been considered to gratify our scientific curiosity. They can be taken into account in the study of the hypertension origin. This study has been limited to healthy women with normal systolic and diastolic pressures, cardiac frequency between 60-100.

The experiments have been carried out upon one thousand healthy women through different ages 20-30 (10/7); 31-40 (11/7); 41-50 (12/8); 51-60 (13/8); 61-70 (14/8); 71-80 (14/7, 15/7). In brackets the blood pressure is indicated. The four former groups are composed of two hundred women each and the two last groups are composed of one hundred women each. It has been pointed out that $\boldsymbol{P_D}$ varies from 3 cm Hg to 8 cm Hg. According the each cross-section of life the cardiac frequency ($\boldsymbol{f_C}$) changes from 60 heart-beats per minute to 100 heart-beats per minute [2,11].

It has been observed that for a given person, $\boldsymbol{P_D}$ and $\boldsymbol{k_k}$ remain constants. From time to time $\boldsymbol{k_k}$ could change. On the other side for a group of persons $\boldsymbol{P_D}$ can be constant while the cardiac frequency may present variations between 60-100. So it has been decided to make general tables from $\boldsymbol{P_D}$= 3 cmHg to $\boldsymbol{P_D}$= 8 cm Hg giving the calculated values of $\boldsymbol{P_C}$ (cardiac power), $\boldsymbol{P_V}$(volumic cardiac power), $\boldsymbol{k_k}$(kinetic constant) for a given differential pressure. The calculations have been completed for the values of cardiac frequencies lower than 60 and past 100.Note however that 60-100 is the interval accepted for normal persons and the volumic cardiac power can be associated to this interval. The cardiac power has been calculated with 80 ml of blood ejected in left ventricular contraction beneath differential pressure. The measures have been taken on the women in comfortable conditions without physical activity and visible emotion. The cardiac power has been reduced to volumic unit and $\boldsymbol{k_k}$ at each $\boldsymbol{P_D}$ has been calculated. The volumic cardiac power has been calculated between 60- 100 of cardiac frequency which are considered as the normal values or the values of healthy persons [2,11]. To verify the validity of Kunyima equation outside this interval (60-100), that means for the persons presenting an anomaly (sick persons), the volumic cardiac power which does not depend on the volume blood in the left ventricular contraction, has been calculated merely by the product of cardiac frequency and differential pressure.

3. RESULTS AND DISCUSSION

Observing the results in the tables and their representation in the figures, wonderful informations can be obtained. The tables give the values of the cardiac frequency, cardiac power, volumic cardiac power and the kinetic constant in small circulation at $\boldsymbol{P_D}$= 3 cm Hg, 4 cm Hg, 5 cm Hg, 6 cm Hg,7 cm Hg,8 cm Hg between of course 60-100 of cardiac frequency. The values outside this interval have been added to verify the validity of Kunyima equation. For each table two figures have been plotted: $\boldsymbol{k_k}$ versus $\boldsymbol{f_C}$ and $\boldsymbol{P_V}$ versus $\boldsymbol{k_k}$. The figures giving $\boldsymbol{k_k}$ versus $\boldsymbol{f_C}$ have all shown clearly the identity between $\boldsymbol{k_k}$ and $\boldsymbol{f_C}$, that means the cardiac frequency is really the kinetic constant of blood circulation (in small circulation). The slopes of figures giving $\boldsymbol{P_V}$ versus k_k have all shown the linear and great dependence of the former parameter (P_V) on the last one (k_k) at the determined differential pressure. The change of cardiac frequency (cardiac rhythm) at a determined differential pressure can be explained. Indeed it is known that the cardiac rhythm acceleration can be induced by the decrease of parasympathetic fibres action or by the increase of sympathetic fibres action. The vegetative nerve centers (regulating the autonomous nerve system activity) situated in the rachidian bulb, receive the different informations (nervous, reflex or not, chemical informations) at each instant about the organism needs: they adapt then the cardiac debit in function of these informations. Also the cardiac rhythm is closely linked to both thrills and physical activity.

In the last figure (Fig. 7), the plots of P_V versus P_D at different cardiac frequencies are shown. Linear correlations are undoubtedly also obtained and the slopes of these plots show in the same way the importance of the dependence of the volumic cardiac power (P_V) on the cardiac frenquency (f_C), more than on differential pressure (P_D). Concerning the cardiac frequency it is known that the organism needs in oxygen change with time and the heart should adapt itself to those variations by modifying its debit. This increase of needs requires an increase of the cardiac debit. This last can increase in enhancing either the volume of the blood ejected in each contraction, or the cardiac frequency. Normally those two mecanisms happen simultaneously, but it is overall the increase of the frequency which is the responsible of the increase of the debit. So it should be noted the volumic cardiac power does not depend any more on volume of blood or on volumic debit, it depends solely on both cardiac frequency

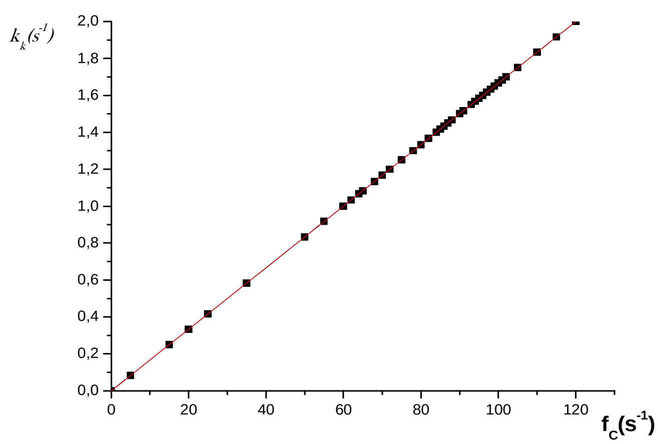


Fig. 1a. Plot of $k_k$versus f_C at $P_D = 3$ cm Hg

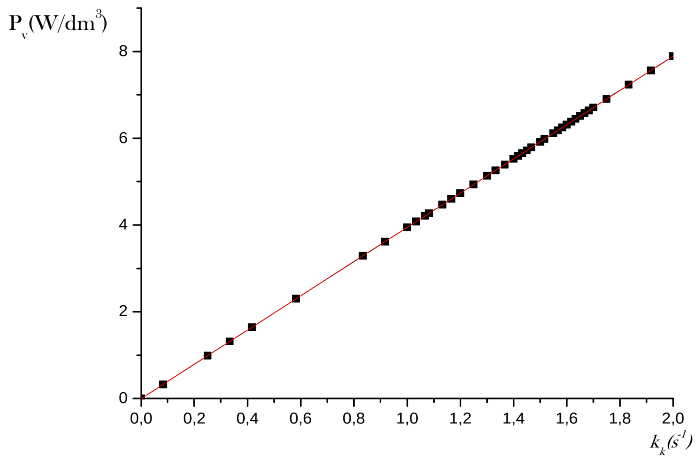


Fig. 1b. Plot of P_V versus k_k at $P_D = 3$ cm Hg

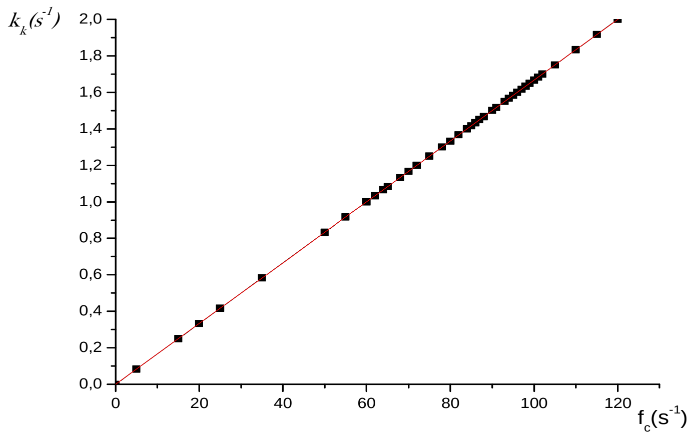


Fig. 2a. Plot of k_k versus f_C at P_D= 4 cm Hg

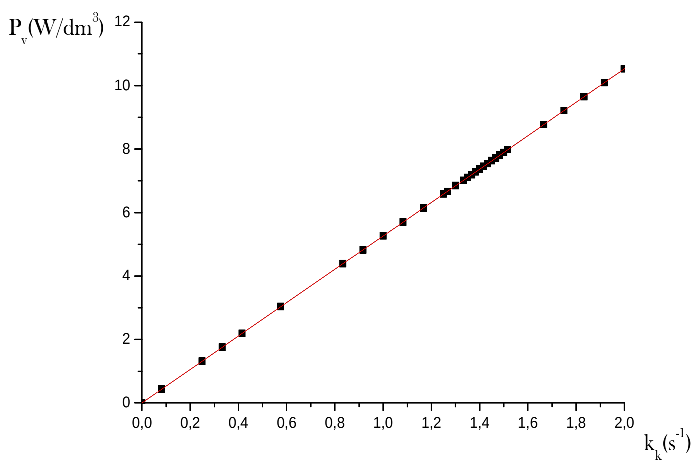


Fig. 2b. Plot of P_V versus k_k at P_D= 4 cm Hg

(kinetic constant) and differential pressure ($\boldsymbol{P_D}$). This is a serious advantage. Also it should be known that the heart works continuously tens of years and this is possible with the proviso that it breeds the minimum of power [10,13,14].

Table 1. Calculated parameters for P_D= 3 cm Hg at each cardiac frequency

f_C *(heart-beats/min)*	P_C*(W)*	P_V*(W/dm^3)*	$k_k(S^{-1})$
0	-	0	0
5	-	0,329	0,083
15	-	0,987	0,250
20	-	1,316	0,333
25	-	1,645	0,417
35	-	2,302	0,583
50	-	3,289	0,833
55	-	3,618	0,917
60	0,316	3,947	1,000
62	0,326	4,079	1,033
64	0,337	4,210	1,067
65	0,342	4,276	1,083
68	0,358	4,473	1,133
70	0,368	4,605	1,167
72	0,379	4,736	1,200
75	0,395	4,934	1,250
78	0,410	5,131	1,300
80	0,421	5,263	1,333
82	0,432	5,394	1,367
84	0,442	5,526	1,400
85	0,447	5,592	1,417
86	0,453	5,657	1,433
87	0,458	5,723	1,450
88	0,463	5,789	1,467
90	0,474	5,921	1,500
91	0,479	5,986	1,517
93	0,489	6,118	1,550
94	0,495	6,184	1,567
95	0,499	6,249	1,583
96	0,505	6,315	1,600
97	0,510	6,381	1,617
98	0,516	6,447	1,633
99	0,521	6,513	1,650
100	0,526	6,578	1,667
101	-	6,644	1,683
102	-	6,709	1,700
105	-	6,907	1,750
110	-	7,236	1,833
115	-	7,565	1,917
120	-	7,894	2,000

Table 2. Calculated parameters for P_D= 4 cm Hg at each cardiac frequency

f_C *(heart-beats/min)*	P_C*(W)*	P_V*(W/dm^3)*	$k_k(S^{-1})$
0	-	*0*	*0*
5	-	0,433	0,082
15	-	1,315	0,249
20	-	1,753	0,333
25	-	2,192	0,416
35	-	3,030	0,576
50	-	*4,386*	*0,833*
55	-	*4,825*	*0,917*
60	*0,421*	5,264	1,000
65	*0,456*	5,702	1,083

f_C *(heart-beats/min)*	P_C*(W)*	P_V*(W/*dm^3)	$k_k(S^{-1})$
70	*0,491*	6,141	1,167
75	*0,526*	6,579	1,250
76	0,533	6,667	1,267
78	0,547	6,843	1,300
80	0,561	7,018	1,333
81	0,568	7,106	1,350
82	0,575	7,193	1,367
83	0,582	7,281	1,383
84	0,589	7,369	1,400
85	0,597	7,457	1,417
86	0,604	7,544	1,433
87	0,611	7,632	1,450
88	0,618	7,719	1,467
89	0,625	7,808	1,483
90	0,632	7,895	1,500
91	0,639	7,983	1,517
100	*0,702*	8,773	1,667
105	-	9,211	1,750
110	-	9,649	1,833
115	-	10,088	1,917
120	-	10,527	2,000

Table 3. Calculated parameters for P_D= 5 cm Hg at each cardiac frequency

f_C *(heart-beats/min)*	P_C*(W)*	P_V*(W/*dm^3)	$k_k(S^{-1})$
0	-	0	0
5	-	0,548	0,083
15	-	1,645	0,250
20	-	2,193	0,333
25	-	2,741	0,417
35	-	3,837	0,583
50	-	5,482	0,833
53	-	5,811	0,883
57	-	6,249	0,950
60	0,526	6,578	1,000
62	0,544	6,797	1,033
64	0,561	7,017	1,067
65	0,570	7,126	1,083
68	0,596	7,455	1,133
70	0,614	7,674	1,167
72	0,631	7,894	1,200
75	0,658	8,223	1,250
76	0,667	8,332	1,267
77	0,675	8,442	1,283
79	0,693	8,661	1,317
80	0,702	8,771	1,333
81	0,710	8,880	1,350
82	0,719	8,989	1,367
84	0,737	9,209	1,400
85	0,746	9,319	1,417

f_C (heart-beats/min)	$P_C(W)$	$P_V(W/dm^3)$	$k_k(S^{-1})$
86	0,754	9,428	1,433
87	0,763	9,538	1,450
90	0,789	9,867	1,500
91	0,798	9,977	1,517
92	0,807	10,086	1,533
93	0,816	10,196	1,550
96	0,842	10,525	1,600
97	0,851	10,634	1,617
100	0,877	10,963	1,667
101	-	11,073	1,683
106	-	11,621	1,767
110	-	12,059	1,833
113	-	12,389	1,883
116	-	12,717	1,933
120	-	13,156	2,000

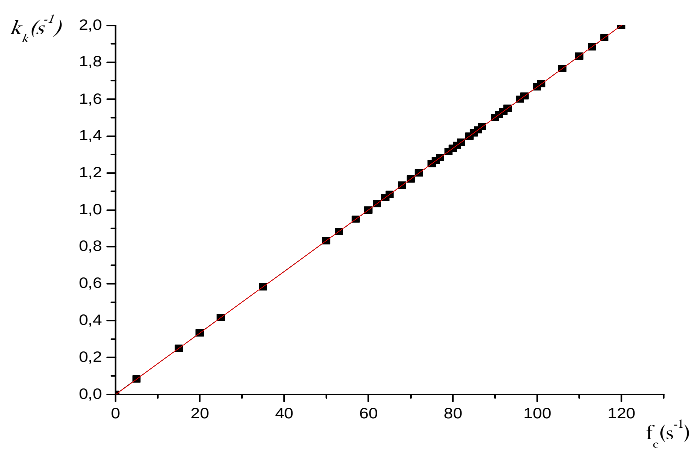


Fig. 3a. Plot of k_k versus f_C at P_D= 5 cm Hg

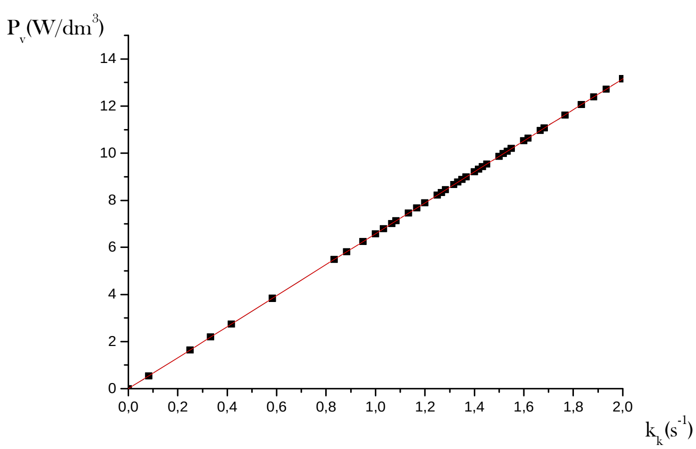


Fig. 3b. Plot of P_V versus k_k at P_D= 5 cm Hg

Table 4. Calculated parameters for P_D= 6 cm Hg at each cardiac frequency

f_C *(heart-beats/min)*	P_C*(W)*	P_V*(W/dm^3)*	$k_k(S^{-1})$
0	-	0	0
5	-	0,658	0,083
15	-	1,974	0,250
20	-	2,631	0,333
25	-	3,289	0,417
35	-	4,605	0,583
50	-	6,578	0,833
52	-	6,841	0,867
53	-	6,973	0,883
58	-	7,631	0,967
60	0,631	7,894	1,000
61	0,642	8,026	1,017
64	0,674	8,420	1,067
65	0,684	8,552	1,083
67	0,705	8,815	1,107
69	0,726	9,078	1,150
70	0,737	9,209	1,167
71	0,747	9,341	1,183
73	0,768	9,604	1,217
75	0,789	9,868	1,250
80	0,842	10,525	1,333
85	0,895	11,183	1,417
86	0,905	11,315	1,433
90	0,947	11,841	1,500
95	0,999	12,499	1,583
99	1,042	13,025	1,650
100	1,053	13,157	1,667
101	-	13,288	1,683
105	-	13,815	1,750
106	-	13,946	1,767
107	-	14,078	1,783
110	-	14,472	1,833
111	-	14,604	1,850
116	-	15,262	1,933
120	-	15,788	2,000

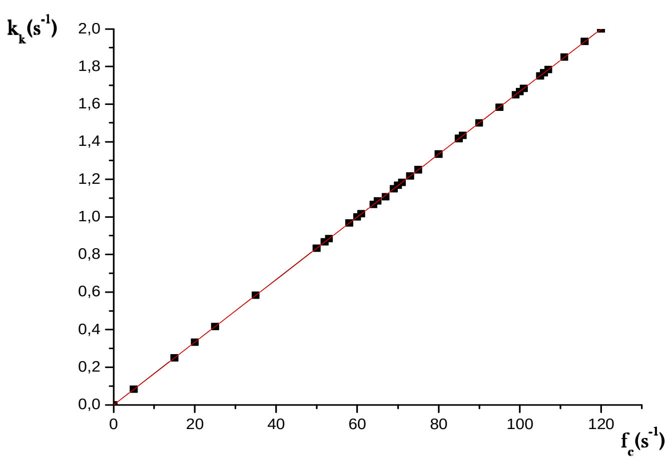


Fig. 4a. Plot of k_k versus f_C at P_D= 6 cm Hg

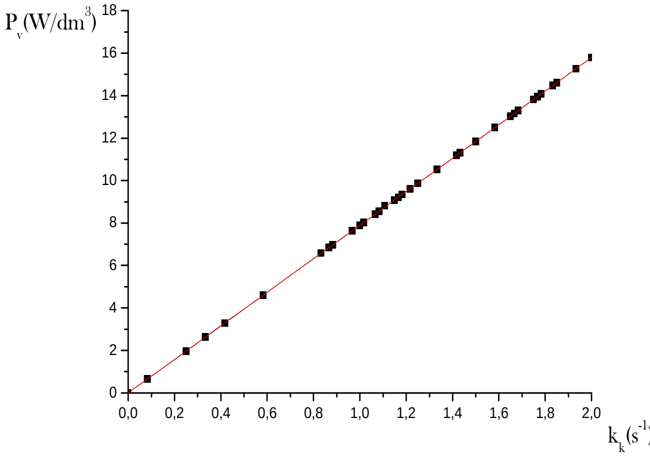


Fig. 4b. Plot of P_V versus k_k at P_D= 6 cm Hg

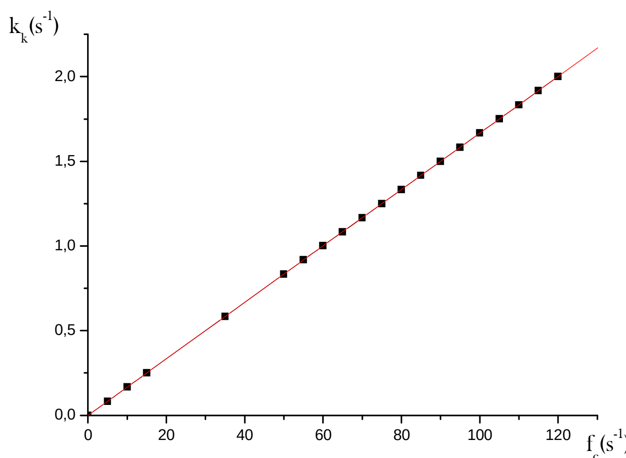


Fig. 5a. Plot of k_k versus f_c at P_D= 7 cm Hg

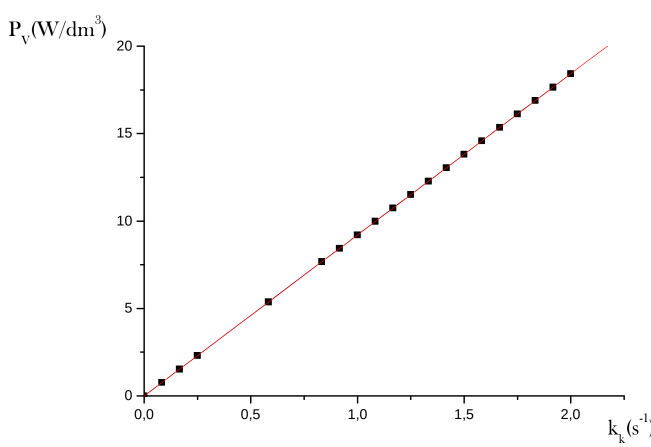


Fig. 5b. P_V versus k_k at P_D = 7 cm Hg

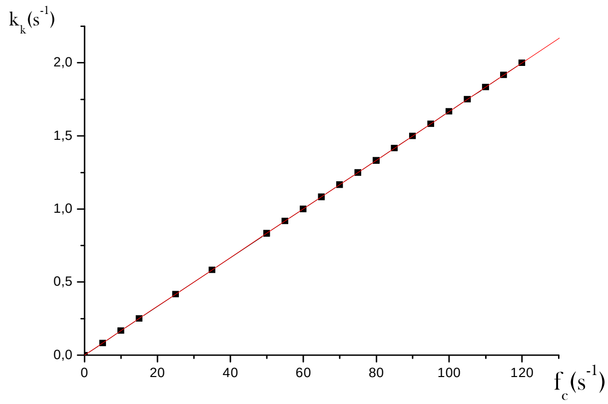


Fig. 6a. Plot of k_k versus f_c at P_D=8 cm Hg

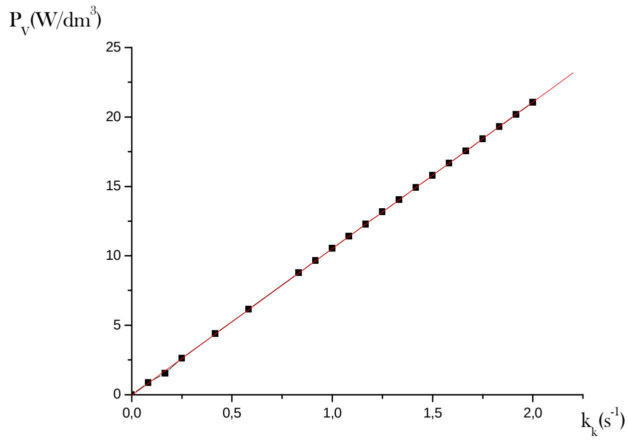


Fig. 6b. Plot of P_V versus k_k at P_D = 8 cm Hg

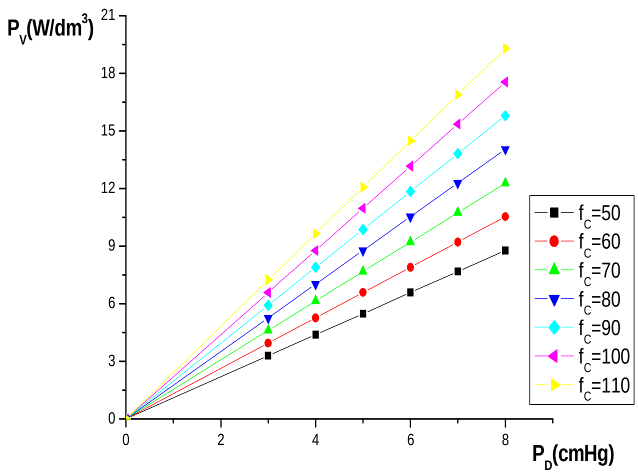


Fig. 7. Plots of P_V versus P_D at different cardiac frequencies

Table 5. Calculated parameters for P_D= 7 cm Hg at each cardiac frequency

f_C (heart-beats/min)	P_C(W)	P_V(W/dm^3)	k_k(S^{-1})
0	-	0	0
5	-	0,768	0,083
10	-	1,535	0,167
15	-	2,303	0,250
35	-	5,373	0,583
50	-	7,675	0,833
55	-	8,443	0,917
60	0,737	9,210	1,000
65	0,798	9,978	1,083
70	0,859	10,745	1,167
75	0,921	11,513	1,250
80	0,982	12,280	1,333
85	1,044	13,048	1,417
90	1,105	13,815	1,500
95	1,167	14,583	1,583
100	1,228	15,350	1,667
105	-	16,118	1,750
110	-	16,885	1,833
115	-	17,653	1,917
120	-	18,420	2,000

Table 6. Calculated parameters for P_D= 8 cm Hg at each cardiac frequency

f_C (heart-beats/min)	P_C(W)	P_V(W/dm^3)	k_k(S^{-1})
0	-	0	0
5	-	0,877	0,083
10	-	1,543	0,167
15	-	2,632	0,250
25	-	4,386	0,417
35	-	6,140	0,583
50	-	8,772	0,833
55	-	9,649	0,917
60	0,842	10,526	1,000
65	0,912	11,403	1,083
70	0,982	12,280	1,167
75	1,053	13,158	1,250
80	1,123	14,035	1,333
85	1,193	14,912	1,417
90	1,263	15,789	1,500
95	1,333	16,667	1,583
100	1,403	17,543	1,667
105	-	18,421	1,750
110	-	19,298	1,833
115	-	20,175	1,917
120	-	21,052	2,000

4. CONCLUSION

This study aims to give fundamental scientific informations to health staff particularly to the heart specialist. It has been hereby demonstrated that cardiac frequency has been found to be the kinetic constant of the blood ejection in the contraction of the left ventricle. Also Kunyima equation has been mathematically verified. The heart is an engine with weak yield and commonly when one speaks engine one speaks power.

The good acting of a heart can be evaluated by the value of the volumic cardiac power and it is desirable to see the sphygmomanometers birth with the power writing in a nearest future concomitantly with cardiac frequency, systolic and diastolic pressures. The volumic cardiac power is more expressive of the heart health in the common imagination than the others parameters. It is noteworthy to realize that the volumic cardiac power in left ventricular contraction can be only calculated by differential pressure and cardiac frequency.

CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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