

Research Article

Evaluation of Cardiovascular Disease Indices in Rats Supplemented with Different Brands of Dietary Vegetable Oils

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Abstract

Purpose: This study aimed to evaluate the impact of commonly used cooking oils on various cardiovascular factors in Wistar rats. **Methods:** Forty-two Wistar rats were involved in the experiment, averaging three months in age and weighing 140 ± 2.45 g. The oils analysed included Palm oil, Emperor oil, Golden Penny oil, Mamador oil, King's oil, and Power oil, all sourced from different markets in Port Harcourt, Nigeria. Each group of Wistar rats was orally administered with 1.0 ml of their respective oil for 30 days, while the control group received no oil. On the 31st day, after a night of fasting, the rats were anaesthetised, and blood samples were collected via cardiac puncture into clearly labelled plain bottles. These blood samples were analysed for lipid profiles using enzymatic methods for the purposes of computing the cardiovascular indices. The cardiac marker CK-MB was evaluated using enzymatic techniques, and cardiac Troponin 1 (cTnI) was measured using the ELISA technique. **Results:** cTnI levels significantly increased in the Golden Penny and Power oil groups at ($p = 0.0195$) compared to the control. CK-MB levels were significantly elevated in the Mamador oil and Emperor oil groups at ($p = 0.0090$). The Castelli Index 1 increased substantially in the Palm oil and Power oil groups, but decreased significantly in the King's oil group compared to the control group at ($p = 0.0184$). **Conclusion:** The impact of various cooking oils on cardiovascular parameters in Wistar rats differs by brand. This implies that the choice of cooking oil should be based on an informed decision, rather than relying on labels.

Keywords

Atherogenic Indices, Cardiovascular Indices, Vegetable Oils, Creatine Kinase – MB, Troponin I

1. Introduction

Cardiovascular diseases (CVD), which encompass conditions such as coronary artery disease, cardiac arrhythmias, cerebrovascular accidents, and heart failure, remain the leading cause of mortality on a global scale [1]. In 2021, an estimated

20.5 million deaths due to CVD were reported [2]. The associated risk factors for cardiovascular disease (CVD) encompass the excessive consumption of alcohol, inadequate nutrition, tobacco use, lack of physical activity, demographic variables including race and ethnicity, advancing age, and genetic

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predispositions, such as familial hypercholesterolemia and renal issues [3]. Individuals may demonstrate these risk factors through conditions such as hypertension, hyperglycemia, elevated blood lipids (dyslipidemia), and complications associated with overweight and obesity [4, 5].

Cooking oils are a vital component of the contemporary diet, serving as an energy source while providing numerous beneficial micronutrients [6]. The connection between cooking oil and cardiovascular disease risks has intrigued researchers for decades. Additionally, concerns about choosing new and emerging cooking oil brands persist [7].

Opinions vary on the rejection of fats. However, certain edible oils contain Omega-3 and Omega-6, essential fatty acids that the body does not produce. Therefore, Omega fatty acid supplements may improve cardiovascular health and other inflammatory conditions, considering that CVD is a leading cause of death worldwide [8].

Trans fats, or trans-fatty acids, are unsaturated fats that occur in natural and artificial forms [5]. Natural trans fats, such as conjugated linoleic acid (CLA), are found in ruminant animal products. Dairy and meat consumers need not worry, as reviews indicate moderate fat intake poses no problem [9, 10].

Artificial trans fats, also known as industrial trans fatty acids (iTFA) or partially hydrogenated fats, pose significant health risks. They are created by chemically modifying vegetable oils to keep them solid at room temperature, increasing their shelf life [11].

Research indicates that inflammation, atherosclerosis, and coronary heart disease (CHD) are exacerbated when trans fats, saturated fatty acids, and cholesterol disrupt the metabolism of essential fatty acids (EFAs), including omega-3 [12]. This highlights the pro-inflammatory role of trans fats, saturated fats, and cholesterol, whereas EFAs and polyunsaturated fatty acids (PUFAs) have anti-inflammatory properties [12]. Despite the health and nutritional value of cooking oil for humans, cooking oils are significant contributors to cardiovascular diseases (CVDs). This paper tends to address the Castelli indices, Troponin I and CK-MB levels in the test and control rat groups, with the purpose of depicting the effect of supplementing various cooking oils on cardiovascular health.

2. Materials and Methods

2.1. Experimental Animals

The experimental animals used in this study were male Wistar rats. Forty-two (42) male Wistar rats were selected, with an average age of twelve (12) weeks and a weight of 140 ± 2.45 g. The rats were purchased from the Department of Animal and Environmental Biology, Rivers State University, Port Harcourt, based on their physical alertness and activity levels. They were housed in a secure cage. The Wistar rats were kept in a conventional wire mesh metal cage measuring 36 inches $\times$ 71 inches. The cage was divided into seven compartments of equal size, which were adequately aerated; the

bedding consisted of pine shavings. The rats were housed in the compartments and maintained under standard laboratory conditions (at room temperature 25°C, 40-50% humidity, and proper ventilation) according to the Guide for the care and use of Laboratory animals [23]. They were allowed to acclimatise to the environment for two weeks. The rats were protected from exposure to rainfall and excessive sunlight. Clean tap water was provided for drinking, and they were fed with pellet feed for the entire experiment.

2.2. Animal Selection and Grouping

A total of 42 Wistar rats were randomly divided into seven (7) groups of 6 rats each, based on the type of oil administered:

Group 1 (Control): Fed with standard rat feed and given clean drinking water.

Group 2 (Palm Oil): Fed with standard rat feed, clean drinking water, and orally gavaged with 1.0 mL of Palm Oil daily.

Group 3 (Emperor Oil): Fed with standard rat feed, clean drinking water, and orally gavaged with 1.0 mL of Emperor Oil daily.

Group 4 (Golden Penny Oil): Fed with standard rat feed, clean drinking water, and orally gavaged with 1.0 mL of Golden Penny Oil daily.

Group 5 (King's Oil): The rats were fed standard rat feed and clean drinking water and orally gavaged with 1.0 mL of King's Oil daily.

Group 6 (Mamador Oil): Fed with standard rat feed, clean drinking water, and orally gavaged with 1.0 mL of Mamador Oil daily.

Group 7 (Power Oil): Fed with standard rat feed, clean drinking water, and orally gavaged with 1.0 mL of Power Oil daily.

2.3. Feeding and Oil Administration

All groups received standard rat feed and clean drinking water ad libitum throughout the 30-day study period. The experiment was conducted over 30 consecutive days to ensure consistent exposure to the oils and facilitate measurable physiological changes.

2.4. Sample Collection Procedure

Following the conclusion of the 30-day experimental period, six rats from each group were selected for analysis. Each rat was anaesthetised using chloroform (CHCl₃) in a well-ventilated environment to ensure minimal stress and humane handling. The anaesthetised rats were positioned supine on a dissecting board, with their limbs gently secured to maintain stability.

A surgical blade was used to create a longitudinal incision along the abdominal midline and an additional incision in the upper left thorax to expose the heart. A sterile syringe was used to extract 5 mL of blood via cardiac puncture directly from the heart. The obtained blood was promptly transferred

into pre-labelled plain bottles. Subsequently, the collected blood samples were centrifuged at 4,000 rpm to facilitate the separation of serum, which was then stored at -20 °C until further biochemical analysis.

2.5. Computation of Atherogenic Indices

Determination of Castelli Risk Index I (CRI-I) by Formula Method

This was obtained by calculating the ratios

$$\text{CRI-I} = \text{TCHOL}/\text{HDL-C}$$

Normal Range (<3.5) indicates a low risk

Determination of Castelli Risk Index II (CRI-II) by Formula Method

This is obtained by calculating the ratios

$$\text{CRI-II} = \text{LDL-C}/\text{HDL-C}$$

Normal Range (<3.0), indicating a low risk

2.6. Determination of Creatine Kinase – MB (CK-MB) by Immunoinhibition Method [13]

Principle

Specific antibody inhibits both M subunits of CK-MM (CK-3), and the single M subunit of CK-MB (CK-2) and thus allow the determination of the B subunits of the CK-MB (assuming the absence of CK-BB or CK-B catalytic concentration, which corresponds to half of the CK-MB concentration is determined from the rate of formation of NADPH, measured at 340 nm, utilising hexokinase and glucose 6 phosphate dehydrogenase coupled reactions.

Procedure

The working reagent and the instrument were brought to 37°C. Forty (40 µL) of the rat serum was pipetted into a sterile labelled test tube containing 1.0 mL of the working solution. The solution was mixed and incubated at 37°C for 15 minutes. At the first 5 minutes of incubation, the absorbance (A1) was read at 340 nm, and at the 15th minute, the absorbance (A2) was read at 340 nm. The concentration of CK-MB in the sample was calculated using a formula.

2.7. Determination of Troponin I (cTn-I) [14]

Principle

The test uses a solid-phase enzyme-linked immunosorbent assay with micro-litre wells coated with monoclonal anti-TnI antibodies. Two antibodies are in the horseradish peroxidase (HRP) conjugate solution. The test sample reacts with the antibodies, sandwiching troponin I molecules between immobilised and enzyme-linked antibodies. After 15 minutes of incubation, the wells are washed to remove unbound antibodies, and a substrate/chromogen is added. The reaction between chromogen and HRP develops a blue colour, which changes to yellow upon adding the stop solution. The troponin I concentration is directly proportional to the test sample's colour

intensity, measured spectrophotometrically at 450 nm.

Procedure

Twenty-five (25) µl of standards, serum samples, and controls were aliquoted into the appropriate wells. Then, 100 µl of enzyme conjugate reagent was added to each well and mixed properly for 30 seconds. The plate was subsequently incubated at 22°C for 15 minutes. After 15 minutes of incubation, the plate was removed and discarded into a waste container to remove the contents of the wells. The wells were washed and rinsed five times with wash buffer (1x). Following the washing and rinsing, the plate was tapped on absorbent paper to remove any residual water droplets. Next, 100 µl of TMB solution was added to each well and mixed for 5 seconds. Subsequently, the plate was incubated at room temperature for 15 minutes. After incubation, 100 µl of stop solution was added to each well and gently mixed for 30 seconds until the solutions changed from blue to yellow. Finally, the optical density was read at 450 nm with a microtitre plate reader.

Statistical Analysis

GraphPad Prism version 9.03 (San Diego, California, USA), the statistical package was used to analyse the data generated. Analysis of variance (ANOVA) and post hoc (Turkey's test) multiple comparisons were used to compare the measured parameters; also, Pearson correlation was used to determine the associations. Results are presented as Mean ± SD, and considered significant at 95% confident interval ($p \leq 0.05$).

3. Results

3.1. Results of Some Atherogenic Indices and Cardiac Markers in Groups of Wister Rats

The Castelli Index 1 results of Wister rats administered with different oils were as follows: Palm Oil: 2.84 ± 2.65 ; Emperor Oil: 2.19 ± 0.61 ; Golden Penny: 1.51 ± 0.26 ; King's Oil: 1.09 ± 0.08 ; Mamador Oil: 1.13 ± 0.17 ; Power Oil: 3.04 ± 2.67 , and the Control: 1.98 ± 0.81 .

The result of ANOVA indicated a significant difference ($P < 0.05$) in Castelli index 1. The result of Post hoc comparisons between each group showed no significant difference ($p > 0.05$) in the mean value of the Castelli-1 index between the Emperor Oil, Golden Penny and Mamador Oil groups and the control group. However, the Castelli index 1 was significantly different ($P < 0.05$), being lower in King's Oil but higher in Palm Oil and Power Oil compared with the control group.

The Castelli Index 2 results of Wister rats administered with different oils were as follows: Palm Oil: 0.91 ± 1.20 ; Emperor Oil: 0.97 ± 0.43 ; Golden Penny: 0.47 ± 0.24 ; King's Oil: 0.07 ± 0.05 ; Mamador Oil: 0.15 ± 0.07 ; Power Oil: 1.40 ± 1.85 , and the Control: 0.44 ± 0.38 .

ANOVA results showed a significant difference ($P < 0.05$) in the Castelli index 2. Post hoc comparisons between each group showed no significant difference ($p > 0.05$) in the Cas-

telli index between the Golden Penny Oil group and the Control. Castelli index 2 was not significantly different ($p > 0.05$) between the Palm Oil and Emperor oil groups, but differed significantly ($P < 0.05$) from the Control. More so, the Castelli index 2 in Mamador and King's Oil was substantially lower ($P < 0.05$) than the Control group. In contrast, power oil groups were higher, differing significantly ($P < 0.05$) from the control group and each other. Castelli index 2 was highest in the Power Oil group and lowest in the King's Oil.

The results of the mean of Creatine Kinase-MB (CK-MB) of Wister rats administered with different oils were as follows: Palm Oil: 37.7 ± 26.39 U/L; Emperor Oil: 47.6 ± 33.79 U/L; Golden Penny: 36.4 ± 21.42 U/L; King's Oil: 32.42 ± 29.32 U/L; Mamador Oil: 42.70 ± 30.71 U/L; Power Oil: 34.65 ± 8.52 U/L, and the Control: 30.1 ± 10.70 U/L.

The ANOVA result showed significant differences ($p < 0.05$) compared to the control group. The Post hoc comparisons of the individual groups with the control indicated that Palm Oil, Golden Penny, King's Oil and Power Oil were not

significantly different ($p > 0.05$) from the Control. However, Mamador Oil and Emperor Oil groups were not significantly different ($p > 0.05$) from each other, but were significantly different (higher) ($p < 0.05$) from the Control group.

The results of the mean of Troponin I of Wister rats administered with different oils were as follows; Palm Oil: 7.93 ± 4.85 ng/mL; Emperor Oil: 8.62 ± 6.37 ng/mL; Golden Penny: 13.08 ± 5.37 ng/mL; King's Oil: 8.12 ± 4.88 ng/mL; Mamador oil: 9.96 ± 4.16 ng/mL; Power Oil: 14.78 ± 7.76 ng/mL and the Control: 7.90 ± 3.82 ng/mL.

The ANOVA comparison revealed a significant difference ($P < 0.05$) between the control group and the experimental group. The post hoc comparisons between individual groups indicated no significant difference ($p > 0.05$) between the Control, Palm Oil, Emperor Oil, Kings Oil and Mamador Oil. However, Troponin-I was significantly elevated ($p < 0.05$), highest in the Power Oil, followed by the Golden Penny Oil, when compared with the Control and other Groups (Table 1).

Table 1. Results of Mean $\pm$ SD of Some Atherogenic Indices and Cardiac Markers in Groups of Wistar Rats Orally Administered Different Cooking Oils Commonly Sold in Nigerian Markets.

Parameters	Control (Group 1)	Palm Oil (Group 2)	Emperor Oil (Group 3)	Golden Penny (Group 4)	King's Oil (Group 5)	Mamador Oil (Group 6)	Power Oil (Group 7)	F value	P value	Remark
Castelli Index1	1.98 ± 0.81^a	2.84 ± 2.65^b	2.19 ± 0.61^a	1.51 ± 0.26^a	1.09 ± 0.08^c	1.13 ± 0.17^a	3.04 ± 2.67^d	2.575	0.0184	S
Castelli Index 2	0.44 ± 0.38^a	0.91 ± 1.20^b	0.97 ± 0.43^b	0.47 ± 0.24^a	0.07 ± 0.05^c	0.15 ± 0.07^d	1.40 ± 1.85^e	1.750	0.1395	N
CK-MB (U/L)	30.1 ± 10.70^a	37.7 ± 26.39^a	47.6 ± 33.79^b	36.4 ± 21.42^a	32.42 ± 29.32^a	42.70 ± 30.71^b	34.65 ± 8.52^a	2.357 4	0.0090	S
Troponin I (ng/ml)	7.90 ± 3.82^a	7.93 ± 4.85^a	8.62 ± 6.37^a	13.08 ± 5.37^b	8.12 ± 4.88^a	9.96 ± 4.16^a	14.78 ± 7.76^b	2.538	0.0195	S

Keys: CK-MB= Creatine Kinase MB, S=Significant at $p < 0.05$

Post Hoc: Values in different rows differ significantly at $p < 0.05$

a, b, c, & d superscripts: values in the same row but having different superscripts are significantly different from each other ($p \leq 0.05$)

3.2 The Association of Creatine Kinase (CK-MB), Cardiac Troponin (cTn), and Atherogenic Indices in Different Brands of Vegetable Oils

The details of associations of creatinine kinase, cardiac troponin I and atherogenic indices in brands of vegetable oils are shown in Tables 2-7. There was a positive correlation between

Castelli Risk Index I and Castelli Risk Index II ($r = 0.86$, $p = 0.004$) when Palm Oil was considered. There was no correlation among the other parameters at $p < 0.05$. There was also a positive correlation between Castelli Risk Index I and Castelli Risk Index II ($r = 0.99$, $p = 0.0003$). A positive correlation was observed between Castelli Risk Index I and Castelli Risk Index II when Mamador was considered ($r = 0.75$, $p = 0.002$). There were no correlations when Golden Penny, Power Oil, Emperor Oil and Kings Oil were considered.

Table 2. Association (Correlation, Pearson's) Results of Creatine Kinase (CK-MB), Cardiac Troponin (cTn), and Atherogenic Indices in Palm Oil.

Parameters	CK-MB	cTn	Castelli Risk Index I	Castelli Risk Index II
CK-MB	r=1.00 p=0.00			
Castelli Risk Index I	r=-0.37 p=0.47	r=0.68 p=0.14	r=1.00 p=0.00	
Castelli Risk Index II	r=-0.42 p=0.41	r=0.68 p=0.14	r=0.86 p=0.004	r=1.00 p=0.00

KEYS: r=Pearson's correlation Coefficient, p= Confident Interval at p<0.05

Table 3. Association (Correlation, Pearson's) Results of Myocardial Specific Creatine Kinase (CK-MB), Cardiac Troponin (cTn), and Atherogenic Indices in Golden Penny Oil.

Parameters	CK-MB	cTn	Castelli Risk Index I	Castelli Risk Index II
CK-MB	r=1.00 p=0.00			
Castelli Risk Index I	r=-0.37 p=0.47	r=0.68 p=0.14	r=1.00 p=0.00	
Castelli Risk Index II	r=-0.42 p=0.41	r=0.68 p=0.14	r=0.99 p=0.00003	r=1.00 p=0.00

KEYS: r=Pearson's correlation Coefficient, p= Confident Interval at p<0.05

Table 4. Association (Correlation, Pearson's) Results of Myocardial Specific Creatine Kinase (CK-MB), Cardiac Troponin (cTn), and Atherogenic Indices in Power Oil.

Parameters	CK-MB	cTn	Castelli Risk Index I	Castelli Risk Index II
CK-MB	r=1.00 p=0.00			
cTn	r=-0.61 p=0.27	r=1.00 p=0.00		
Castelli Risk Index I	r=-0.38 p=0.53	r=-0.36 p=0.54	r=1.00 p=0.00	
Castelli Risk Index II	r=0.30 p=0.62	r=-0.29 p=0.63	r=-0.30 P=0.62	r=1.00 p=0.00

KEYS: r=Pearson's correlation Coefficient, p= Confident Interval at p<0.05

Table 5. Association (Correlation, Pearson's) Results of Myocardial Specific Creatine Kinase (CK-MB), Cardiac Troponin (cTn), and Atherogenic Indices in Emperor oil.

Parameters	CK-MB	cTn	Castelli Risk Index I	Castelli Risk Index II
CK-MB	r=1.00 p=0.00			
cTn	r=-0.624 p=0.184	r=1.00 p=0.00		
Castelli Risk Index I	r=0.415 p=0.412	r=-0.214 p=0.683	r=1.00 p=0.00	
Castelli Risk Index II	r=0.753 p=0.083	r=-0.668 p=0.146	r=0.793 p=0.059	r=1.00 p=0.00

KEYS: r=Pearson's correlation Coefficient, p= Confident Interval at p<0.05

Table 6. Association (Correlation, Pearson's) Results of Myocardial Specific Creatine Kinase (CK-MB), Cardiac Troponin (cTn), and Atherogenic Indices in Mamador Oil.

Parameters	CK-MB	cTn	Castelli Risk Index I	Castelli Risk Index II
CK-MB	r=1.00 p=0.00			
Castelli Risk Index I	r=-0.37 p=0.47	r=0.68 p=0.14	r=1.00 p=0.00	
Castelli Risk Index II	r=-0.42 p=0.41	r=0.68 p=0.14	r=0.75 p=0.002	r=1.00 p=0.00

KEYS: r=Pearson's correlation Coefficient, p= Confident Interval at p<0.05

Table 7. Association (Correlation, Pearson's) Results of Myocardial Specific. Creatine Kinase (CK-MB), Cardiac Troponin (cTn), and Atherogenic Indices in Kings Oil.

Parameters	CK-MB	cTn	Castelli Risk Index I	Castelli Risk Index II
CK-MB	r=1.00 p=0.00			
cTn	r=-0.166 p=0.753	r=1.00 p=0.00		
Castelli Risk Index I	r=0.155 p=0.768	r=0.580 p=0.227	r=1.00 p=0.00	
Castelli Risk Index II	r=0.231 p=0.658	r=0.016 p=0.974	r=-0.623 p=0.185	r=1.00 p=0.00

KEYS: r=Pearson's correlation Coefficient, p= Confident Interval at p<0.05

4. Discussions

The CK-MB level significantly increased in the Matador and Emperor oil groups, while Troponin I rose dramatically in the Power and Golden penny oil groups. The level of the Castelli index1 was significantly increased in the Palm oil and Power oil groups. These findings may impact the heart health status of the consumers. [15], asserted that the repeatedly heated vegetable oils increase the effect of lipid peroxidation and aggravate the development of CVD.

The levels of the Castelli Indices significantly increased in Palm Oil, Emperor Oil, and Power Oil, but it was reduced in the king's oil and matador oil groups. In a relegated study, [7] suggested that suggests that oils high in saturated fats, such as coconut oil and palm oil, increase total cholesterol and LDL concentrations but also raise high-density lipoprotein concentrations.

The correlation of the various brands of cooking oils, such as Palm Oil, Emperor Oil, Golden Penny Oil, Kings Oil, Mammador Oil, and Power Oil, revealed no correlation. Given these findings, it is imperative to make informed decisions, taking into account the potential regulatory roles (positive or negative) that Omega fatty acids may play in achieving the overall benefits for the heart and for future targeted dietary recommendations.

Regarding cardiovascular markers (CK-MB, cTn, and Castelli Index I and II), the different cooking oil brands administered significantly affected atherogenic indices, such as the Castelli Index I.

The cooking oil consumed significantly affected atherogenic indices, such as the Castelli Index 1. The Power Oil group exhibited the highest Castelli Index 1, a marker of increased cardiovascular risk, while the King's Oil group showed the lowest value. This suggests that certain cooking oils containing appropriate unsaturated fats, like King's Oil usually supplemented with Omega 3 and 6, may have beneficial roles in safeguarding against heart disease by lowering atherogenic indices which agree with various literatures [16-19] that these functional lipids (ω -3 and ω -6 FAs), besides being an integral part of cell-membrane phospholipids, they also play diverse physiological functions, including reducing levels of inflammatory markers, lowering cholesterol levels, mitigating inflammation in cardiac disease, inflammatory bowel disease, preventing hardening of the arteries, and lowering blood pressure.

Cardiac markers, such as CK-MB and Troponin I, revealed significant elevation in some oil groups, suggesting myocardial injury. The Emperor Oil group showed the highest CK-MB (47.6 ± 33.79 U/L), a marker for myocardial damage, while Troponin I was significantly higher in the Golden Penny and Power Oil groups. These results present an impression that certain oils may exacerbate myocardial injury, emphasising the importance of choosing cardio-protective

cooking oils in diets like Palm Oil, which had the lowest troponin I levels amongst all the cooking oil treatment groups when compared with the control group, and literature alludes that Consumption of palm oil does not adversely affect cardiac biomarkers [20].

Also, it was revealed that Palm Oil significantly increased Castelli index 1 and 2 but did not significantly affect cTi and CK-MB when compared with the control. Our findings on CK-MB agreed with the report of [20], that palm oil consumption did not adversely affect CK-MB. Evidence shows that a moderate intake of palm oil within a healthy diet presents no risks for health [21]. The differences observed in our study with other studies may be due to the different amounts of palm oil used and the refinement of the palm oil. In a similar report no effect of palm oil on cardiovascular risk [22].

5. Conclusion

The CK-MB level significantly increased in the matador and emperor oil groups, while Troponin I significantly increased in the power and golden penny oil groups. The level of the Castelli index1 was significantly increased in the palm oil and power oil groups. The levels of the Castelli II index significantly increased in palm oil, emperor oil, and power oil, but it was reduced in the king's oil and matador oil groups. Significant positive correlations between Castelli Risk Index I and Castelli Risk Index II in the Palm oil, Power oil, and Emperor Oil.

The intricate nexus between the various brands of cooking oils and cardiovascular indices calls for imperative informed decisions when faced with the choices of which brand is better. Accordingly, consumers, if well informed, will make better choices on which brands benefit them. The policy makers and regulatory agencies should, from time to time, ensure that the actual contents of the brands are what is displayed.

Abbreviations

CVDs	Cardiovascular Diseases
TCHOL	Total Cholesterol
TG	Triglyceride
LDL	Low-density Lipoprotein Cholesterol
VLDL	Very Low-density Lipoprotein Cholesterol
GC-MS	Gas Chromatography-mass Spectrometry
WHO	World Health Organisation
cTn	Cardiac Troponin I
CK-MB	Creatine Kinase MB

Conflicts of Interest

The authors declare no conflicts of interest.

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