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LAPAROSCOPIC INSTRUMENT CARE: A COMPARATIVE STUDY OF OLIVE OIL & ARGAN OIL FOR INSTRUMENT LUBRICATION

By

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Abstract

Background: *Care and maintenance of laparoscopic instruments are essential for their functionality and durability. Standard lubricants recommended for laparoscopic instruments are either unavailable or expensive to acquire in low-resource settings. Hence, there is need to explore available oils for lubrication of these instruments.*

Aim: *To compare the effectiveness of Olive Oil and Argan Oil in lubrication and instrument maintenance.*

Methods: *This was a descriptive, cross-sectional comparative study done using eighteen (18) laparoscopic instruments. The instruments under study were divided into two groups with the same type of instrument in the respective groups. The instruments were lubricated with the oils and observed for ease of movement, residue formation and rust formation afterwhich appropriate data analysis was conducted to compare the effectiveness of both oils in laparoscopic instrument lubrication.*

Results*: Argan and Olive oil showed equal values for residue formation and rust formation but slightly different values for ease of movement. However, the difference observed is not statistically significant, hence not sufficient enough to indicate any divergence in effectiveness of lubrication in either oil.*

Conclusion: *Both oils showed equal effectiveness in preventing corrosion, promoting ease of movement and preventing residue formation. Hence, given their biocompatiblity, both oils are suitable and safe for laparoscopic instrument lubrication, especially in low-resource settings.*

Keywords: *Laparoscopic instrument, surgical instrument care, Olive Oil, Argan Oil, lubricant effectiveness, instrument lubrication.*

1. INTRODUCTION

1.1 Background

Laparoscopic surgeries are the cutting edge surgical methods of the modern day. They offer shorter post-operative recovery time, less postoperative pain, early mobilisation and feeding, early return to work/normal activity, and better cosmetic results, compared to other open surgical techniques. [1]

Surgical instruments used in this type of surgery requires precise attention to their care, as they are delicate and expensive to acquire, maintain and repair. Proper care and handling of laparoscopic instrumentation can help to prolong their lifespan and maintain them at an optimal performance level. [2]

Lubrication is an important part of the care of these instruments. It is recommended to minimise wear and tear and to ensure the smooth functioning of these surgical instruments, thereby ensuring their durability.[3] Nonlubrication leads to rusting of the laparoscopic instruments and reduction of their life span. The qualities of a good lubricant include; compatibility to the surgical instrument material and sterilisation, nonreactivity, biocompatiblity, appropriate viscosity, water-solubility, easy application and removal, non-toxicity, and non-allergenic.[4,5] However the ideal lubricant

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does not exist and standard lubricants (which possess most of these qualities) are either limited in availability or expensive.

Oil-based lubricants were used for this study. Olive Oil is a natural oil, cheap and readily available. It contains 15% saturated fatty acids and 85% unsaturated fatty acids which afford it a good oxidation stability, making it suitable as a lubricant.[6] On the other hand, Argan Oil contains triglycerides and related derivatives. It can be more resistant to oxidation than Olive Oil, depending on the method of extraction.[7] Disaar Natural Argan oil was the branded oil used and cosmetic sites describe it as a naturally derived oil, containing essential fatty acids and Vitamin E. It can be applied to the skin, hair, nails, and used in meal preparation, highlighting its biocompatiblity and non-irritant qualities.[8] Compared to Olive Oil, Argan Oil is lighter in viscosity, allowing better fluidity and spread of the oil on the lubricating surface. As both are vegetable oils, they are biodegradable and ecofriendly, causing little to no adverse effects to the environment.

The use of natural oil as a lubricant can be dated to the invention of machines, as this was the readily available option. However, with the development of petrochemicals, mineral-oil-based lubricants were used instead. This posed an environmental risk to biolife and led to adverse effects on the ecosystem. The potential substitutes to these mineral-oil based lubricant are vegetable oils and synthetic esters.[9]

Already published papers on ideal lubricants fail to analyse the use of locally available oils as lubricant for laparoscopic instruments and their effectiveness in instrument maintenance, as the focus has only been on use of water-soluble lubricants instead. This is especially important in resource-deficient regions, where standard lubrication may be unavailable. The index study aims to compare the effectiveness of natural oils - Olive Oil and Disaar Natural Argan Oil (a cosmetic oil) - in laparoscopic instruments lubrication, providing relevant information for the use of these locally available oils.

1.2 Aim

To compare the effectiveness of Olive Oil and Argan Oil in lubrication and instrument maintenance.

1.3 Objectives

- To assess efficiency of the Olive Oil and Argan Oil in laparoscopic instrument lubrication
- To evaluate the extent of the anti-corrosive properties of these oils.
- To determine the ease of movement, residue formation and and rust formation of instruments lubricated with the respective oils.

2. METHODOLOGY

2.1 Study Design

This study will employ a descriptive cross-sectional, comparative study design. This is ideal for comparison between two groups (Olive Oil lubricated instruments and Argan oil lubricated instruments)

2.2 Study Materials

- Laparoscopic instruments: Traumatic, semi-traumatic and atraumatic forceps; Maryland forceps; Laparoscopic hook scissors.
- B7 Be Free Extra Virgin Olive Oil in a sterile universal bottle
- Disaar Natural Argan Oil in a sterile universal bottle

2.3 Procedure

All instruments were cleaned with antiseptic solution and dried. The mobile parts of the instruments were then dipped in 30 ml of the respective oils and tagged for identification. The same type of instrument was used for the two lubricant groups. Afterwards, the lubricated instruments were stored in similar conditions for a 24-72 hour period, avoiding confounding factors that may alter the results. They were then observed for rust formation, ease of movement, and residue formation. This was repeated over six (6) months.

2.4 Outcome Measures

- Rust formation on the lubricated laparoscopic instruments

i. Residue formation on the laparoscopic instrument
ii. Ease of movement of the laparoscopic instrument.

2. 5 Data Collection

This was done by visual inspection and functional testing. Application of the lubricant on all instruments used were done by the same person. This was to ensure homogeneity of application method and reduce the disparity in the results.

2.6 Data Analysis

The results were analyzed using SPSS Versions 25. Counts and percentages were used to summarise the data while Fisher's Exact Test was used to check for statistical significance, using a p-value of <0.05.

3. RESULTS

The following sections outline the results and analysis of the data collected on the lubrication efficiency of Olive Oil and Disaar Natural Oil. A total of eighteen (18) laparoscopic instruments were used in the study; nine (9) instruments for each oil with the same type of instrument used in each group. The results will be outlined under the following variables;

- Rust formation
- Rust formation
- Residue formation

3.1 Rust Formation

Table 3.1 Rust Formation

Outcome	Olive Oil (n=9)	Disaar Argan Oil (n=9)	Total
Rust Formation	0 (0%)	0 (0%)	0
No rust	9 (100%)	9 (100%)	18

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formation			

From a total of eighteen (18) instruments, no rust formation was observed in either the Argan Oil (0/9) or Olive Oil (0/9) group. As there are no differences between the two groups, no statistical significance was observed.

3.2 Ease of movement

Table 3.2 Ease of movement

Outcome	Olive Oil (n=9)	Disaar Natural Argan Oil (n=9)	Total
Ease of movement	8 (88.89%)	9 (100%)	17
Reduced ease of movement	1 (11.11%)	0 (0%)	1

From a total of nine (9) instruments lubricated with Olive Oil, 11.11% (1/9) had reduced ease of movement and 88.89% (8/9) instruments had normal ease of movement. All instruments lubricated with Argan Oil (9/9) had normal ease of movement.

Due to the small sample size, Fisher's Exact Test was used to test for statistical significance. This arrived at a two-sided p-value of 1.000 (i.e., >0.05). Hence, the difference observed in the ease of movement between the study groups is not statistically significant.

3.3 Residue Formation

Table 3.3 Residue Formation

Outcome	Olive Oil (n=9)	Disaar Natural Argan Oil (n=9)	Total
Residue formation	0 (0%)	9(100%)	9
No residue formation	0 (0%)	9(109%)	9

From a total of eighteen (18) instruments, no rust formation was observed in either the Argan Oil (0/9) or Olive Oil (0/9) group. As there are no differences between the two groups, no statistical significance difference was observed.

4. DISCUSSION

Laparoscopic lubrication is an integral part of laparoscopic instrument maintenance. It increases the durability of the instrument and reduces surgical risk associated with poorly functioning instrument. Previous studies highlight the importance of instrument lubrication on its durability[3], however scarce articles are available on the use and effectiveness of natural oils in instrument lubrication, and fewer on the use of cosmetic oils for the same purpose. However, this should not be so as natural oils offer better biocompatiblity, lesser adverse effects on the ecosystem and non-irritant properties. This study explored the use of Olive Oil and a cosmetic oil - Argan Oil, for laparoscopic instrument lubrication.

In this study, rust formation was not observed for either group of laparoscopic lubricant. This further proves that Olive Oil & Argan Oil are equally effective in the prevention of rust formation and in the maintenance of laparoscopic instruments. Rust is formed by an interaction between moisture, oxygen and iron; hence, oil-based lubricants prevent rust formation by forming a protective layer against water and oxygen.[10] The findings from the index study, supports the use of oil-based lubricants for laparoscopic instrument maintenance.

The ease of movement of laparoscopic instruments is dependent on the friction between the hinged surfaces. Lubrication improves movement by interfering between the surfaces in contact and reducing the coefficient of friction.[11] This is particularly significant in surgical instrument use, as it reduces the rate of complications due to poorly functioning instruments. The relatively reduced ease of movement observed in Olive Oil is of no statistical significance and could be attributed to the higher viscosity of Olive Oil compared to Argan Oil.

Residue, in the index study, refers to the deposition of excess oil on the surface of the lubricated instrument, even after a specified period of time. This, in turn, can promote the growth of microorganisms on the instrument and interfere with sterilisation.[9] In the index study, there was no residue formation in either instrument groups. This is significant, in that it reduces the concern of the oil lubricant trapping dust deposits and microorganisms. The relatively low viscosity of the oils used could be contributory, as this reduces the amount of oil that may remain on the surface of the lubricated instrument, thus eliminating the possibility of residue being formed. Hence, Argan Oil and Olive Oil can both be used without the risk of residue formation.

The index study is limited by the lack of comparison against a standard lubricant. This reduces the objectivity of the findings. Also, the assessment of ease of movement may be partly subjective to the observer despite standardisation of results. However, a strong point of this study is the inclusion of residue formation as a parameter to be assessed, which further helped to describe the appropriateness of the respective oils in regards to the risk of surgical infection.

CONCLUSION

The above results and analyses, showed that Argan Oil and Olive Oil have comparable lubrication effectiveness and anti-corrosive properties. These findings, in addition to their biocompatiblity and availability, make them suitable and environmentallly safe for laparoscopic instrument lubrication in resource-limited settings, without any adverse effect to the outcome of the surgical procedures or the durability of the instrument.

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CONSENT

Informed consent was not applicable as the study involved inanimate objects and no human or animal subject was involved.

ETHICAL APPROVAL

Ethical approval was obtained from the Health Research Ethics Committee of the University of Port Harcourt.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

FUNDING

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APPENDICES

Olive Oil used for the study

Argan Oil used for the study

Images of rusted atraumatic laparoscopic forceps following poor instrument care.

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