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Organoleptic And Macroscopic Properties Of The Wood Anatomy Of Five Species From A Subhumid Forest For Conservation Purposes In San Ignacio

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Abstract. *Currently, the use of wood for different purposes has increased, consequently, its demand and commercial value has been increasing, however, to use it appropriately, it is essential to understand its anatomical characteristics, being a fundamental aspect that the industry forestry needs to continually supply itself with raw materials and give the purpose of its usefulness. As described, there is a need to generate technical and scientific knowledge of the important forest species of the sub-humid forests of the area, so this research seeks to fill these knowledge gaps to better understand the forest species of the sub-humid forests. humid areas and give an efficient purpose to the forestry industry. The procedure that was carried out for the description of organoleptic and macroscopic properties was through the senses: smell, touch, taste and sight. The results were described in elaborate formats, accompanied by descriptions and photographs. It was possible to describe in detail the organoleptic characteristics of the five study species*
Keywords: *Wood, Macroscopic, anatomy, organoleptic properties.*

INTRODUCTION

Sub-humid forests have been overexploited for their wood for the construction industry and carpentry, as they present good behavior to structures, consequently, their demand and commercial value has been increasing. However, in order to make proper use of wood, it is essential to understand its anatomical characteristics, being a fundamental aspect that the forestry industry needs to continuously supply itself with raw material and give the purpose of its usefulness.

Sub-humid forests have been overexploited for their wood for the construction industry and carpentry, as they present good behavior to structures. Species such as the michino, acerillo, iguaguana, oak and latero, have been for some years very demanded and extracted from these forests, for the uses already mentioned; Although they are widely consumed species in the carpentry industry, all their technological information is based on studies of these species from other areas and types of forests, so it is necessary to know the general, organoleptic and macroscopic characteristics of the wood of the species under study, since they constitute a very important factor. since it influences the selection of this for use in construction, interior decoration or cabinetmaking, allowing us to use forest species efficiently. However, to date, there is no reliable technical and scientific information to guarantee. For the present study, the objective has been to identify the organoleptic and macroscopic properties of the wood anatomy of five species from a subhumid forest. The organoleptic characteristics of the five species under study were described.

MATERIALS AND METHODS

Boards with tangential view, tables with radial view, slices with cross-sectional view, magnifying glass, camera, forms, pencil and pencils, container with water.

Preparation stage: To obtain the wood samples, it was considered to obtain specimens with the dimensions of 15 cm x 9 cm 2 cm, in accordance with COPANT standards (1972). Within this stage, the boards and slices were presented, with the respective views of the species under study, then sanded until fine surfaces were obtained, data collection instruments were developed, taking into account the organoleptic characteristics of the wood (color, smell, flavor, grain direction, brightness, grain or design and texture).

Determination stage: The organoleptic characteristics were determined using the senses: smell, touch, taste and sight. Color was observed using the Munsell chart. The odor was evaluated as aromatic, astringent, fragrant and sweet. As for the flavor, it was evaluated as spicy, sour, sweet, unpleasant, pleasant and bitter, it should be noted that in some species the smell and taste are usually absent. For luster it was evaluated in high, medium and low, the veining was cataloged in satin marbled or parallel bands and overlapping arches. Texture was evaluated using the sense of touch, classified as fine, medium and coarse. For grain (Lema, 2018).

Research Content

The study has characteristics of a descriptive, prospective research because the information used comes from primary data and according to the number of analytical variables it is descriptive (because it had only one variable), in agreement with Hernández et al. (2014).

Population: Made up of all forest species of the Sub-humid forest. Sample. Design: It is made up of the five research species : the present study presents a prevalent research design, since it is a descriptive and cross-sectional study, and only aims to make known the natural state of an event, it is observational.

Anatomy of wood

To carry out the anatomical studies of the wood, Chavesta (2006) indicates that it is necessary to make cuts in different planes. In the tree and cells of the xylem three sections or planes can be defined. For the cross-section, Hoadley, B (1990), mentions that in this section you can see the growth rings, size of the rays, you can also see the porosity, parenchyma, even conductive tissues such as the phloem and also the different coloration that is observed in the sapwood and heartwood. In reference to the radial and tangential cuts, Giménez et al., (2005), indicates that the incision goes parallel to the radial channels of the wood.

Macroscopic structure of wood

To study the macroscopic structure of wood, given its heterogeneity, three planes or sections are established.

- Transverse: Perpendicular to the axis of the branch or trunk.
- Radial: It passes through the axis and a radius of the branch or trunk.
- Tangential: Parallel to a plane tangent to the trunk, or to the growth ring.

By examining the three sections in a log of wood, with the naked eye, the following structures can be observed with easily distinguishable characteristics.

- The outer cortex or cortex itself.
- The inner bark or bast.
- The cambium or thin layer of living cells generates the growth in thickness of the tree (xylem and phloem).
- The wood or woody tissue itself, which forms the majority of the trunk and presents differences, easily noticeable in conifers and in some hardwoods. Among these are those due to growth rings (García, 2003).

1. Medulla: Central part of the stems, formed mainly by parenchymal or soft tissue (Chavesta, 2016). It can be circular, polygonal or star-shaped. It is of little importance, it is generally small and is discarded in the processes of wood processing (García, 2003).
2. Woody rays: While most cells in wood are elongated parallel to the stem, a small number of cells approximately less than 10% of the volume are elongated perpendicular to the stem (Taquire, 2000). They are important in the characteristics of wood as an element of identification and as responsible, in part, for its shrinkage properties (García, 2003).
3. Sapwood and Heartwood: The sapwood, the wood responsible for transporting the brute sage, occupies the outermost place of the trunk. Generally lighter in color than heartwood. The formation of heartwood is characterized by anatomical and chemical modifications (García, 2003).
4. Growth rings: It is a continuous mantle of cells that, in the shape of a cone, is superimposed on the existing rings. The growth rings in the developing tree result from the reproductive activity of the cambium, which is found under the bark (Diaz, 2003). When observing the cross-section of a piece of wood, a series of concentric circles can be distinguished, which are called rings or growth increments (León and Espinoza, 2001). On the radial surface, the growth increments appear as parallel stripes, and in the tangential section they assume variable concentric shapes and "U" or "V" shapes (Pérez, 1984).

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Organoleptic characteristics

Aróstegui (1975) mentions that, in order to study the macroscopic and microscopic structure of wood, due to its great heterogeneity, three planes or sections are established, which are the transverse, the radial and the tangential. Aróstegui (1982) also says that the macroscopic structure corresponds to the characteristics of the different tissues of the wood observed with the naked eye or with a 10X magnifying glass. Tuset and Durán (1986) say that cells together form the different tissues and can be divided into 2 longitudinal or axial types, that is, their largest dimension or main axis is parallel to the axis of the tree and transverse or horizontal whose major axis is transversal to the axis of the tree. Among the first type we have woody vessels (pores), fibers, parenchymal cells, gummy channels, tracheids and resiniferous channels.

The macroscopic characteristics of wood are all those characteristics that can be perceived by the sensory organs. They are subdivided into two classes: those attributable to their cellular structure (parenchyma, pores, radii) and those attributable to their physicochemical properties (color, smell, weight and hardness) (Chavesta, 2005).

Color is the most obvious character when we look at wood. This is due to the presence of xylocrome substances (resins, gums, tannins) inside the cells. In general, two well-defined areas of different colors can be observed in the cross-sections (Moglia, 2014).

The odor is caused by the volatilization of certain chemical components, for example, resins, gums or oils that are emanated from the wood when the species are felled. In case the wood is dry, the odor is determined by wetting the sample, distinguishing two types: distinctive and non-distinctive.

Flavor is a very common characteristic in wood, but it is related to aroma, in both cases they are produced by the essential oils of the species (Aguilar & Guzowski, 2011).

The gloss or luster refers to the level that the wood has to be able to reflect light, this ability will be affected by two factors: the level of inclination of the surface to the light and the type of cells found in it (Chavesta, 2012).

Texture is related to the amount of "wood substance" present, because it depends on the size of the cell and the thickness of the cell wall. The texture is influenced by the tangential diameter of the vessels or tracheids, the abundance, height and width of the rays, the abundance of parenchyma, etc. Coarse texture: large anatomical elements easily observable with the naked eye. Medium texture: medium anatomical elements are observed with the naked eye, but with difficulty. Fine texture: very small anatomical elements are not differentiated, appear to be homogeneous and can be observed with the help of magnifying glass (Chavesta, 2012).

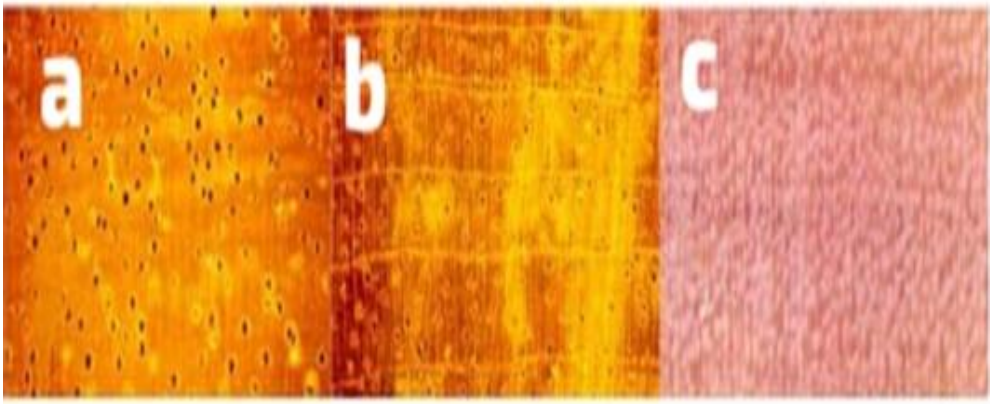

Figure 1. Coarse texture (a), medium texture (b) and fine texture (c).

The grain is the arrangement of each element in the longitudinal section of the wood sample in reference to the shaft axis. It is determined by locating the place in the transverse plane in a cube obtained from the species, and then placing a blade in that section, following the direction of the radii and hitting with a wooden mallet, verifying the lesser or greater difficulty that the wood offers to be cut in a longitudinal direction. Straight grain: It occurs in case each element is directed forming angles of 90° in reference to the trunk of the tree. Oblique grain: In this case, each element that makes up the wood is directed so that it forms an angle of less than 90°, in the same way in reference to the axis of the tree. Cross-linked grain: when the elements of the wood sample are arranged in an opposing way, making it difficult to separate it (Moglia et al., 2014).

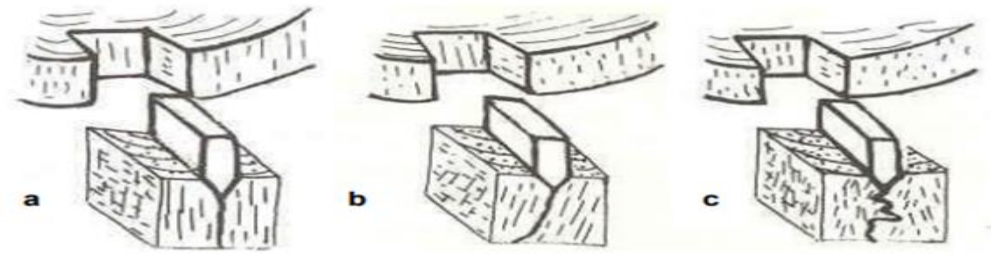

Figure 2. Straight grain (a), inclined grain (b) and cross-linked grain (c).

The grain is the design that originates in the tangential and radial surface of the wood, generally to observe it must be polished, these figures are due to the elements that constitute the wood (growth rings, radii, etc.) and the abundance of them. Overlapping arcs: originated mainly by growth rings, visible only on tangential surfaces. Marbling: visible only on radial surface and wide-radius species, as these are responsible for the design. Parallel bands: visible on the radial surface, mainly with well-marked growth ring species and abundant parenchymal tissue. Satin: visible on the radial surface, it is characterized by light and dark parallel stripes or bands, influenced by the crisscross grain. (Chavesta, 2012).

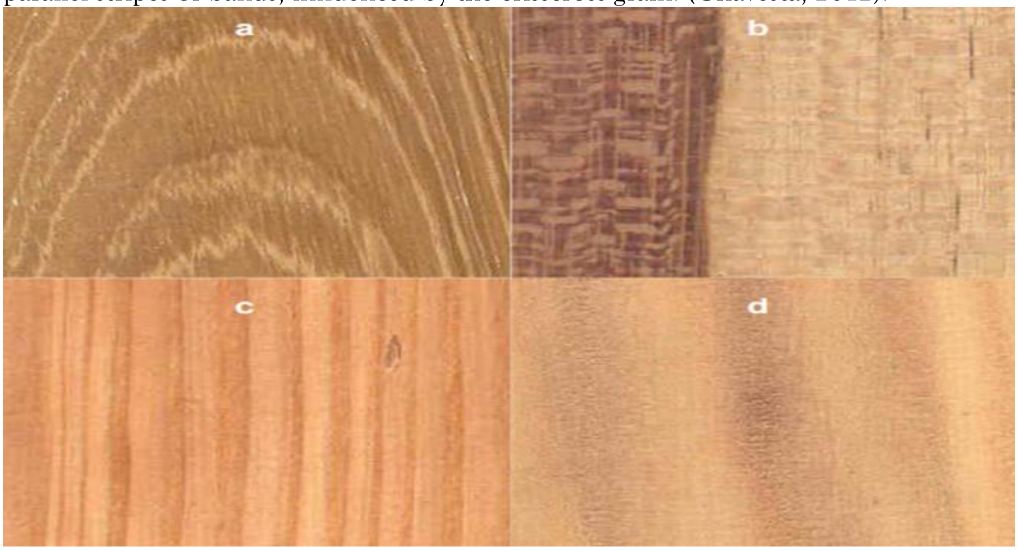

Figure 3. Overlapping arches (a), marbled (b), parallel bands (c) and satin (d).

Implications of anatomical elements in manufacturing processes

Implications for wood drying

The type of grain influences the drying quality of the wood, since straight, inclined and cross-grained wood, under similar drying conditions, present different types and percentages of defects, the most stable being the straight grain. Likewise, the inclusions present in the wood significantly affect the drying time and quality; The presence of thylosis, gums, oils and calcium pockets make it difficult for the water to escape from the vascular elements, often causing the wood piece not to dry completely. Also, the length and diameter of the vascular elements influence the removal of water from the wood; When the length of a vascular element is less than its diameter, the perforation platen, which joins these elements longitudinally, makes it difficult for water to escape

Implications for sawmilling and workability of wood

These operations are affected by the type of grain and the inclusions that the wood presents. A wood with a straight grain in the orthogonal (band saw or circular) or peripheral (garlopa, planer) cut, generally does not have warping during cutting, nor does it have torn grain or hairy surfaces (red hookah). Likewise, a wood with an inclined grain shows slight warping and surfaces of torn grain or light villous such as strong devil and screw. Finally, wood with crisscross grain presents pronounced warping that causes the pieces to "close" or "open" significantly during cutting and their surfaces show plucked or accentuated hairy grain (almond, huayruro, mashonaste). Wood inclusions, such as pockets of calcium or silica, accelerate the wear of cutting elements, reducing the quality of surfaces when there is no proper use of the cutting elements. This forces to reduce the sharpening time of the discs, belts or blades of the machines, in turn reducing their useful life (sapote, shihuahuaco, mashonaste). Finally, the rubbers and oils during cutting adhere to the teeth and edges of the cutting elements, interfering with the evacuation of sawdust and

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shavings, which causes excessive friction, which distempers the cutting elements and burns the surfaces of the wood (copaiba, cedar, fig).

Implications for the finishing of furniture and products

The texture and inclusions of the wood influence the finishing process of timber products. A fine-textured wood requires less finishing material (varnish, lacquers and paints) because it has very small pores and little presence of parenchyma (capirona, quinilla). In the case of a coarse texture, due to having larger pores and abundant parenchyma, it requires a greater amount of material to achieve the same quality of finish (screw, maquisapa ñaccha). Inclusions, such as oils and gums, delay the drying of the finishing material and, in the case of oils, which emerge towards the outside of the piece, cause an "agglobation" of the finished surface (cedar, copaiba).

RESULTS

Macroscopic properties of wood Aspidorsperma polyneuron

Heartwood color:
Qualitative: Pinkish orange
Quantitative: RGB scale, R= 211; G= 163; B = 127; Hex=

Sapwood Color:
Quantitative: Creamy Yellow
Qualitative: RGB scale, R=241; G = 230; B = 211; Hex=

Brillo Natural: Bajo
Chandelier: Bajo

Odor: Non-distinctive
Taste: Bitter

Grain: Cross-linked
Veining: radial: parallel lines, tangential: overlapping arcs with little differentiation

Pores: Abundant pores, solitary with the presence of parenchyma
Spokes: Thin, discontinuous
Textures: Fine

TANGENTIAL

RADIAL CUT

CROSS-SECTION

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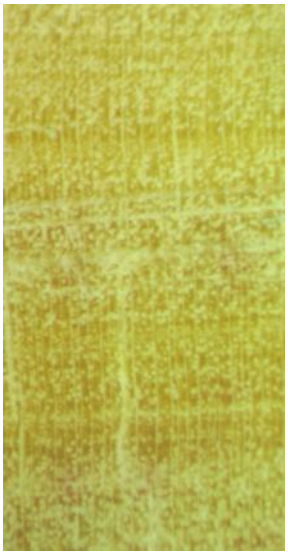


Macroscopic properties of Cordia iguaguana wood 1

Heartwood color:
Qualitative: Dark Brown
Quantitative: RGB scale, R== 74; G= 57; B = 48; Hex=

2

Heartwood color:
Qualitative: Creamy Yellow
Quantitative: RGB scale, R=213; G= 202; B = 179; Hex=

3

Natural Shine: Low
Gloss: Low

Odor: Non-distinctive
Taste: Non-distinctive

4
5

Grain: Cross-linked
Veining: radial: parallel lines, tangential: well-differentiated overlapping arcs.

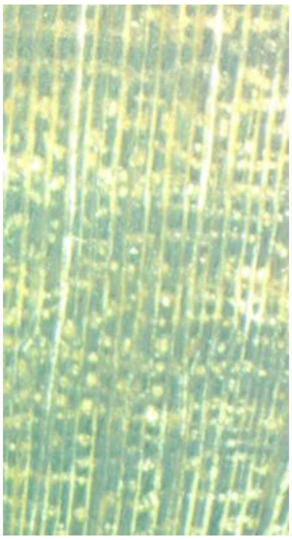
Pores: Abundant pores, solitary with the presence of parenchyma
Spokes: Thin, discontinuous
Exturas: Fine

6
7

TANGENTIAL SECTION

RADIAL CUT

CROSS-SECTION 8



Macroscopic properties of Licaria trianda wood

Heartwood color:
Qualitative: Light Brown
Quantitative: RGB scale, R= 167; G = 156; B = 129; Hex=

Sapwood Color:
Quantitative: Creamy Yellow
Qualitative: RGB scale, R=227; G= 219; B = 187; Hex=

Natural Gloss: High
Gloss: High

Odor: Rancid irritant
Taste: Bitter

Grain: Cross-linked
Veining: radial parallel lines, tangential overlapping arches with little differentiation

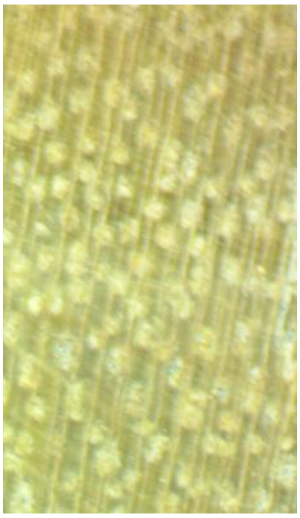
Pores: Abundant pores with the presence of parenchyma, solitary and radially grouped.
Spokes: Thin, continuous
Textures: Medium

TANGENTIAL

RADIAL CUT

CROSS-SECTION





Macroscopic properties of Manilkara bidentata wood

Heartwood color:
Qualitative: reddish brown
Quantitative: RGB scale, R= 151; G= 105; B = 71; Hex=

Sapwood Color:
Quantitative: Light Brown
Qualitative: RGB scale, R= 211; G=169; B = 137; Hex=

Brillo Natural: Bajo
Chandelier: Bajo

Smell: Medium camphor
Taste: Bitter

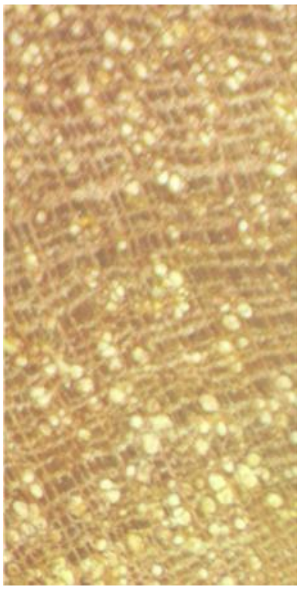
Grain: Cross-linked
Veining: radial parallel lines; tangential satin

Pores: Solitary and radial grouped with the presence of parenchyma
Spokes: Thin thin spokes, dashed spokes
Textures: Medium

TANGENTIAL SECTION

RADIAL CUT

CROSS-SECTION


Macroscopic properties of Nectandra reticulata wood

Heartwood color:
Qualitative: light brown (not much different)
Quantitative: RGB scale, R= 204; G= 193; B = 172; Hex=

Sapwood Color:
Quantitative: Creamy Yellow
Qualitative: RGB scale, R=232; G= 224; B = 190; Hex=

Natural Gloss: High
Gloss: High

Smell: Camphor
Taste: Non-distinctive

Grain: Cross-linked
Veining: radial: parallel lines, tangential: overlapping arcs with little differentiation

Pores: solitary pores grouped in pairs; with the presence of parenchyma
Spokes: Thin, discontinuous
Textures: Coarse

TANGENTIAL

RADIAL CUT

CROSS-SECTION

DISCUSSION

The macroscopic properties and of the species Cordia iguaguana, Manilkara bidentata, Nectandra reticulata, Aspidosperma polyneuron, Licaria trianda were determined. It was found that the species Licaria trianda presented rings of non-perceptible growth, solitary and grouped pores surrounded by abundant parenchyma, fine and continuous rays; in the species Cordia iguguana presented rings of perceptible growth, solitary pores surrounded by abundant parenchyma, fine and discontinuous rays; in the species Manilkara bidentata it presented rings of perceptible growth, solitary and grouped pores surrounded by abundant parenchyma, fine, thin and discontinuous rays; in the species Nectandra reticulata it presented poorly perceptible growth rings, solitary and grouped pores surrounded by abundant parenchyma, fine and discontinuous rays; in the species Aspioderma polyneuron it presented poorly perceptible defined growth rings, solitary pores of abundant parenchyma, fine and discontinuous rays. Portal (2022) carried out a study on the species Cordia alliodora of which the results obtained indicated that as the wood of the species has a reddish color, medium texture, the growth rings are visible with 10x lipa, it has diffuse apotracheal parenchyma in aggregate, vasicentric, aliform and confluent paratracheal, and non-stratified rays. While Egües (2021) evaluated the species Juglans neotropica Diels, the results indicated that the species has marked growth rings, whose structure presents large pores at the beginning, then smaller pores; ending with bands of marginal parenchyma delimiting the ring. At the macroscopic level, it presented medium texture, straight grain, solitary pores and multiple radial pores of 2 to 3; semicircular porosity; parenchyma in thin and marginal bands.

CONCLUSIONS

The macroscopic properties and properties of the Cordia iguaguana species were determined, where it was obtained that it presented rings of perceptible growth, solitary pores surrounded by abundant parenchyma, fine and discontinuous rays. In the species Liacaria rianda presented rings of non-perceptible growth, solitary and grouped pores surrounded by abundant parenchyma, fine and continuous rays. In the species Manilkara bidentata presented rings of perceptible growth, solitary and grouped pores surrounded by abundant parenchyma, fine, thin and discontinuous rays. In the species Nectandra reticulata it presented rings of scarce perceptible growth, solitary and grouped pores surrounded by abundant parenchyma, fine and discontinuous rays; in the species Aspioderma polyneuron it presented poorly perceptible defined growth rings, solitary pores of abundant parenchyma, fine and discontinuous rays.

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Conflicts of interest: "The authors declare that they have no conflicts of interest." "Funders had no role in the design of the study; in the collection, analysis or interpretation of data; in the writing of the manuscript; or in the decision to publish the results."

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