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Evaluation of the effect of a hair cosmetic treatment through a clinical test

• Evelyn Falconi Klein¹ • Massimo Perrone² • Claudio Angelinetta³ • Antonino Di Pietro⁴



EVELYN FALCONI KLEIN

SUMMARY

The purpose of this clinical test is to evaluate the effect in improving hair resistance to breakage, hair volume, hair structure of an hair cosmetic treatment.

This test was performed under dermatological control as follows: 20 panellists with an age between 18 and 60 and with thin and fragile, thin, damaged hair were recruited and were asked to use the utilized product () twice per week for 56 consecutive days.*

During this period, the following instrumental and clinical parameters have been evaluated: hair resistance at breakage, hair structure, hair volume, hair overall condition, split ends presence.

According to the obtained results, we can state that the cosmetic treatment, in the volunteers who underwent the clinical test, has proved to have an effect improving hair resistance to breakage, hair volume, overall hair condition and in reducing the split ends presence. The treatment has also proved to have a good acceptability of use.

() They have been used three commercial products named FORTIKER Active Shampoo, FORTIKER Active Mask and FORTIKER Active Lotion based on Glixina Complex.*

KEYWORDS

Hair, hair resistance, hair structure, hair volume, glycogen, fucoxanthins, sulphur-containing amino acids

INTRODUCTION

Alteration of hair structure and hair physical properties, split ends, and other hair problems are particularly prevalent among people who repeatedly alter the natural style of their hair or among people with hair that is intrinsically weak.

Cosmetic products can help improving the structural integrity of hair fibers, increasing tensile strength, stimulating

new hair growth.

During this clinical study, a cosmetic treatment containing the Glixina complex, which is composed of Glycogen, Fucoxanthin and a Pool of Amino Acids, was tested.

The cosmetic treatment is composed by a shampoo, mask and lotion with the same active ingredients.

Glycogen is a reserve polysaccharide obtained from corn starch by a process

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of enzymatic synthesis. Natural glycogen is normally found in the skin and other tissues, but tends to decrease in quality with age.

Fucoxanthin is a polysaccharide from the xanthin class extracted from red and brown algae *Asparagopsis armata* and *Ascophyllum nodosum*.

The Pool of Amino Acids was selected as the composition of keratin, a sulphur rich protein that is essential for the structure of the hair.

Hair cosmetics are widely used to alter the physical and mechanical properties of hair, which are dependent on internal structural organization and protein constituents.

Hair structure and properties can be damaged by several factors, like UV irradiation, pollution and repeated cosmetic treatments (for example hair dye, hair straightener)

Hair structure and hair physical properties

Hair is a filamentous biomaterial consisting mainly of proteins in particular keratin.

The hair shaft of mammals is divided into three main regions: cuticle, cortex and medulla. The medulla is present in coarser hair like grey hair, thick hair and beard hair, and it is absent in fine hair of children. The medulla may be involved in the splitting of hairs since it provides an area of weakness as a pathway for the propagation of cracks along the axis of the fiber [3, 4].

The cuticle is a chemically resistant region and consists of flap overlapping scales (keratinocytes) like shingles on the roof. The shape and orientation of the cuticle cells

are responsible for the differential friction effect in hair. Each cuticle cell contains a thin proteinaceous membrane, the epicuticle, covered with a lipid layer that includes the 18-methyl eicosanoic acid (18-MEA) and free lipids. Beneath the cuticle cells membranes there are three layers, all containing heavily cross-linked protein, mostly cystine, the A-layer, the exocuticle or B-layer and the endocuticle. The first one contains the higher amount of cystine, and the third one contains the lowest. The 18-MEA is responsible for the hydrophobicity of the hair and its removal by alkaline chemical cosmetics procedures may damage hair by increasing hydrophilicity [5].

The cell membrane complex (CMC) is intercellular matter. CMC consists of cell membranes and adhesive material (cement) binding the cell membranes between two cuticle cells, two cortical cells and cuticle-cortex cells. The most important layer of the CMC is called the beta-layer, and it is considered to be the intercellular cement and it is sandwiched by other layers from each cell. The CMC and the endocuticle are very vulnerable regions to the chemical treatments such as bleaching, dyeing and hair straightening/perm procedures. Also, the everyday grooming and shampooing friction may disrupt the CMC [3, 4, 5].

The exposure to repeated rough washing, unprotected drying, friction actions, sunlight and alkaline chemical treatments lead to a decrease in the lipid content of the cell surface changing it from the state of hydrophobicity to a more hydrophilic, negatively charged surface

[3, 4, 5, 6].

The cortex constitutes the major part of the mass of the human hair, and it is formed by fusiform cells connected by a CMC and contains protein and melanin granules. The cortex cell also contains spindle-shaped fibrous structures called macrofibrils, each one consists of microfibrils that are highly organized fibrillar units and matrix. The matrix is formed by crystalline protein of high cystine content. The macrofibrils are arranged in a spiral formation. Inside the microfibrils there are subfilamentous units called protofilaments, each contains short sections of alpha-helical proteins in coiled coil formation polypeptide chains of proteins.

The alpha-helix is held coiled by chemical forces such as: Ionic forces, hydrogen bonds, Van de Waal forces and disulfide bonds. Hair straightening process consists on breaking the forces that hold the coil, allowing it to be stretched.

Hair damage caused by the use of chemical procedures can be minimized, avoided or repaired by the correct use of hair care products. Hair cosmetics may enhance hair hydrophobicity, strengthen the cuticle and minimize electrical charges and friction forces [2, 5, 6, 8].

Treatment

The Glixina complex is based on the synergy of glycogen, fucoxanthins and sulphur-containing amino acids.

Glycogen is found in the human hair follicle, where it is also metabolized, especially in the external root sheath cells. The external root sheath

th forms a non-keratinizing region of the peripheral hair follicle and is in continuity with the epidermis.

Moreover, it contains large quantity of glycogen at the base of the hair follicle.

Glycogen is the energy source for protein synthesis during hair growth and its presence in the external root sheath suggests an energy-consuming activity in these cells.

Histologically, the external sheath of the hair root is noticeable at the base of the hair bulb like a thin layer of pale cells.

Closer to the surface, cells are bigger and columnar. Inside the keratogenic area, the external root sheath is enlarged and layered and cells are enriched in glycogen and have a clear cytoplasm. The glycogen storage in the root sheath is used as source of energy and nutrients for the bulb cells activities.

During the hair cycle, the glycogen amount varies according to the hair phase.

The hair growth stage (anagen phase) consumes glucose twice as fast as the telogen phase.

Fucoxanthins exerts a direct antioxidant effect, acting as a reactive oxygen species (ROS) scavenger. Additionally, it possesses an anti-inflammatory activity and is effective in reducing the concentration of pro-inflammatory cytokines, like TNF- α and PGE2 (usually secreted at the start of the inflammation process).

The Sulphur-containing amino acids play a crucial role in the keratin structure, a fibrous and slightly soluble protein found in hair and nails.

Keratin contains a huge quantity

of cysteine, an amino acid characterized by the presence of a thiol (-SH) group. When the thiol groups of two cysteine residues (as in monomers or constituent units) are brought close together during protein folding, an oxidative reaction can generate a cystine unit with a disulfide bond (S-S).

The disulfide bonds give strength, stiffness and thermostability to keratin. If burnt, keratin releases a pungent odor due to the presence of Sulphur components.

Keratin contains a big amount of glycine and alanine, which are the simplest amino acids.

EXPERIMENTAL PART

→ Scope

The purpose of this clinical test is to evaluate the effect in improving hair resistance to breakage, hair volume, hair structure of an hair cosmetic treatment.

→ Legal information

In accordance with the current legislation and the declaration of Helsinki, all volunteers must be adequately informed of the aims, methods, clinical trial details, anticipated benefits and potential undesirable effects of the study. Each panellist must sign an informed consent form, which is managed and archived by applying the internal procedure of a Certified Quality Management System.

The study has been carried out at CDC - Dermo-clinic Research Institute

Viale Misurata 56, 20146 – Milan (Italy)

Clinical test features

→ Subjects

20 female subjects, with an age between 18 and 60 years have been selected for the test, following the undermentioned inclusion criteria:

- thin, damaged and fragile hair;
- good state of health/absence of psychological and/or cognitive disorders;
- no dermatopathies and allergic pathologies (to cosmetics or other specific excipient), or other pathologies (as unknown irritant responses);
- no ongoing pharmacological treatments that could affect the result of the test;
- no participations in other clinical trial during the previous 30 days;
- signature of the informed consent form.

→ Preparation of the samples

Samples of the tested product have been applied following their usual use: rinse off.

→ Method of application of the samples

Volunteers used the tested product twice per week for 56 consecutive days, as follows:

- FORTIKER Active Shampoo
Apply with a gentle massage on the scalp and rinse thoroughly.
- FORTIKER Active Mask
Apply on the hair after FORTIKER Active Shampoo, with a gentle massage starting by the ends till the radix. Leave on for few minutes and then rinse-off.
- FORTIKER Active Lotion
Apply with a gentle massage on the scalp after the use of FORTIKER Active Shampoo and FORTIKER Active Mask.

EXECUTION OF THE TEST

→ Instrumental parameters

- Hair resistance to breakage (break force)*

**This instrumental parameters were taken with a DYNAMOMETER which measures both the force (Newton) needed to break hair (this measurement is performed on a single hair) and the force needed to comb it (measurement on the entire hair lock). It's an index of hair weakness.*

Measurements have been performed setting dynamometer as follow:

- speed of the terminal: 100 mm/min
- Load ID/ FS [N] cell: 20 N
- Test-piece length: 50 mm
- Pretension: 5 cN

Each measurement taken is the average of 5 hair.

→ Clinical parameters

- Hair volume
- Split ends presence
- Overall hair condition
- Analysis of the hair structure performed by using a digital microscope system.

• Observation of the hair allows to analyse the shaft, verify the presence of dry and exhausted hair ends or trichoptilosis (split ends) and to evaluate hair brightness and hair hydration.

→ Self-evaluation

Volunteers opinions are also taken after product use: at [t56].

This self-evaluation was performed according to VNS scale where 0 is the minimum value and 10 is the maximum value.

→ Evaluation and reckoning of the instrumental results

The statistical analysis has been performed using Student's t-test.

INTRA-GROUP: Paired t-test threshold of acceptability: 1%.

→ Evaluation of the clinical results

The statistical analysis has been

performed using the Wilcoxon rank sum test: we decided to fix the threshold of acceptability at 5%.

To carry out a statistical survey and to be able to evaluate the variations in a specific period, the following parameters have been analyzed:

Hair volume Overall hair condition	
Insufficient hair condition Insufficient hair volume	Insufficient
Sufficient hair condition Sufficient hair volume	Sufficient
Fairly good hair condition Fairly good hair volume	Fairly good
Good hair condition Good hair volume	Good
Very good hair condition Very good hair volume	Very good

Split ends presence	
Insufficient hair condition	Absent
Sufficient hair condition	Sufficient
Fairly good hair condition	Fairly good
Good hair condition	Good
Very good hair condition	Very good

SUMMARIZING TABLES OF THE VALUES AND REMARKS

→ Instrumental parameters

Resistenza del capello alla rottura / Hair resistance to breakage(Newton)				
Rif. Vol. Vol. ref	T0	T14	T28	T56
1	0,442	0,454	0,501	0,507
2	0,474	0,525	0,535	0,555
3	0,660	0,670	0,710	0,765
4	0,762	0,787	0,804	0,810
5	0,474	0,448	0,500	0,484
6	0,529	0,545	0,602	0,617
7	0,643	0,645	0,714	0,702
8	0,698	0,699	0,650	0,723
9	0,699	0,743	0,680	0,712
10	0,687	0,726	0,699	0,735
11	0,653	0,697	0,699	0,711
12	0,686	0,675	0,699	0,725
13	0,639	0,670	0,652	0,694
14	0,638	0,678	0,654	0,678
15	0,673	0,655	0,779	0,730
16	0,441	0,484	0,469	0,503
17	0,638	0,688	0,699	0,701
18	0,576	0,614	0,613	0,621
19	0,728	0,722	0,743	0,755
20	0,629	0,604	0,598	0,719
Media Average	0,618	0,636	0,650	0,672

Tempi di rilevazione Survey times	Numero di osservazioni Number of observations	Media Average	Deviazione Standard Standard deviation	p-value	Significatività Significance (p-value<0,01)
T0	20	0,6	0,0964282		
T14	20	0,6	0,0972942	0,005853958	sì/yes
T28	20	0,7	0,0929884	0,001256499	sì/yes
T56	20	0,7	0,0929884	9,36412E-09	sì/yes

Hair resistance to breakage:

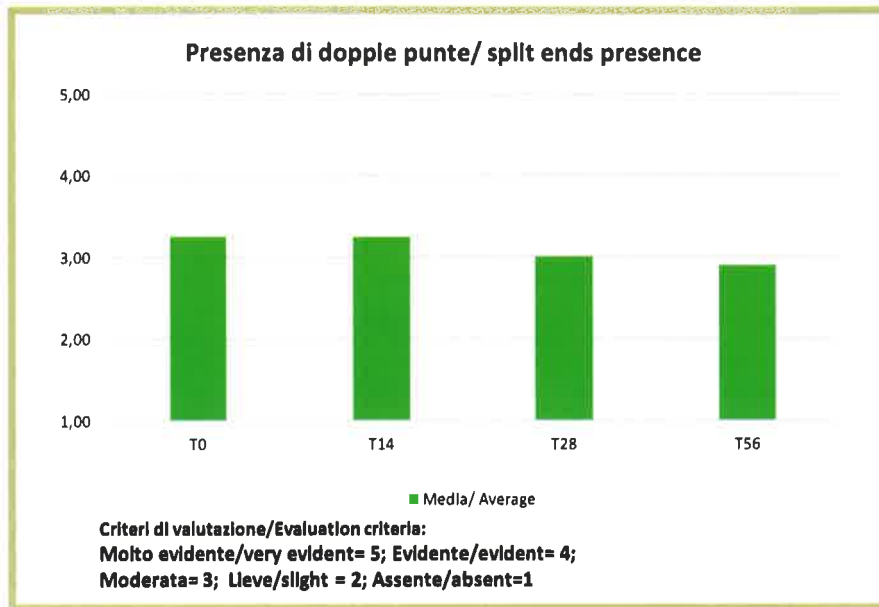
3% after 14 days of treatment use (statistically significant)

5% after 28 days of treatment use (statistically significant)

9% after 56 days of treatment use (statistically significant)

→ **Clinical parameters**

Rif. Vol. Panellist code	Presenza di doppie punte/ split ends presence			
	t0	t14	t28	t56
1	Moderata/Moderate	Moderata/Moderate	Moderata/Moderate	Moderata/Moderate
2	Moderata/Moderate	Moderata/Moderate	Moderata/Moderate	Lieve/Slight
3	Moderata/Moderate	Moderata/Moderate	Lieve/Slight	Lieve/Slight
4	Moderata/Moderate	Moderata/Moderate	Moderata/Moderate	Moderata/Moderate
5	Evidente/Evident	Evidente/Evident	Moderata/Moderate	Moderata/Moderate
6	Moderata/Moderate	Moderata/Moderate	Moderata/Moderate	Moderata/Moderate
7	Moderata/Moderate	Moderata/Moderate	Moderata/Moderate	Moderata/Moderate
8	Moderata/Moderate	Moderata/Moderate	Moderata/Moderate	Moderata/Moderate
9	Evidente/Evident	Evidente/Evident	Moderata/Moderate	Moderata/Moderate
10	Evidente/Evident	Evidente/Evident	Evidente/Evident	Evidente/Evident
11	Moderata/Moderate	Moderata/Moderate	Moderata/Moderate	Lieve/Slight
12	Moderata/Moderate	Moderata/Moderate	Moderata/Moderate	Moderata/Moderate
13	Moderata/Moderate	Moderata/Moderate	Moderata/Moderate	Moderata/Moderate
14	Evidente/Evident	Evidente/Evident	Evidente/Evident	Evidente/Evident
15	Evidente/Evident	Evidente/Evident	Evidente/Evident	Evidente/Evident
16	Moderata/Moderate	Moderata/Moderate	Lieve/Slight	Lieve/Slight
17	Moderata/Moderate	Moderata/Moderate	Moderata/Moderate	Moderata/Moderate
18	Moderata/Moderate	Moderata/Moderate	Moderata/Moderate	Moderata/Moderate
19	Moderata/Moderate	Moderata/Moderate	Lieve/Slight	Lieve/Slight
20	Moderata/Moderate	Moderata/Moderate	Moderata/Moderate	Moderata/Moderate
Media/ Average	3,25 Molto evidente/Very evident	3,25 Moderata/Moderate	3,00 Molto evidente/Very evident	2,90 Molto evidente/Very evident



α	0,05	Code	2
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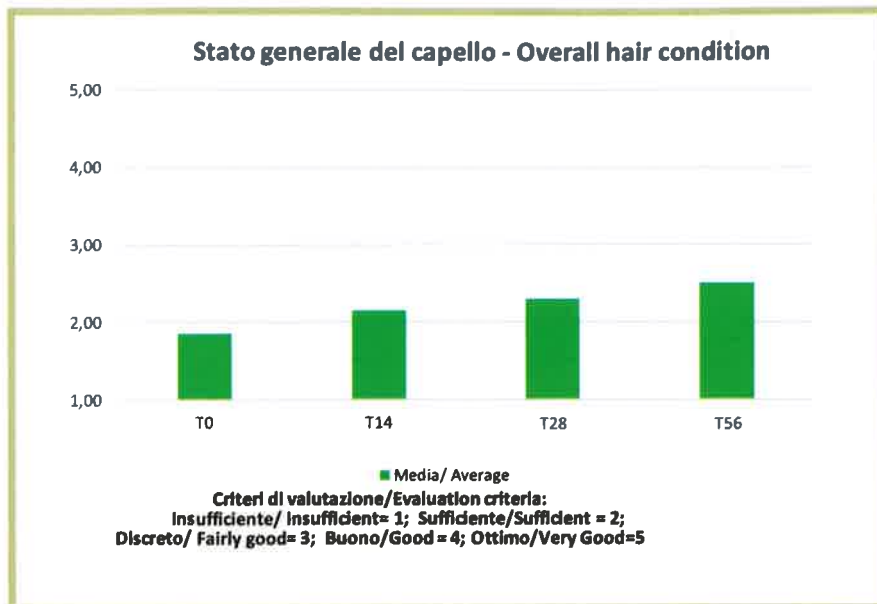
							Significatività/ Significance
T0 - T14	n	0	T	0	T-crit	—	no
T0 - T28	n	5	T	0	T-crit	**	no
T0 - T56	n	7	T	0	T-crit	2	si/yes

Split ends presence decreases in the:

25% of the panelists after 28 days of use (no statistically significant)

35% of the panelists after 56 days of use (statistically significant)

Rif. Vol. Panelist code	Stato generale del capello - Overall hair condition			
	t0	t14	t28	t56
1	Insufficiente/Insufficient	Insufficiente/Insufficient	Sufficiente/Sufficient	Sufficiente/Sufficient
2	Sufficiente/Sufficient	Discreto/Fairly good	Discreto/Fairly good	Discreto/Fairly good
3	Sufficiente/Sufficient	Discreto/Fairly good	Discreto/Fairly good	Discreto/Fairly good
4	Sufficiente/Sufficient	Sufficiente/Sufficient	Sufficiente/Sufficient	Discreto/Fairly good
5	Insufficiente/Insufficient	Insufficiente/Insufficient	Insufficiente/Insufficient	Insufficiente/Insufficient
6	Sufficiente/Sufficient	Sufficiente/Sufficient	Discreto/Fairly good	Discreto/Fairly good
7	Sufficiente/Sufficient	Sufficiente/Sufficient	Sufficiente/Sufficient	Discreto/Fairly good
8	Sufficiente/Sufficient	Sufficiente/Sufficient	Sufficiente/Sufficient	Sufficiente/Sufficient
9	Sufficiente/Sufficient	Sufficiente/Sufficient	Discreto/Fairly good	Discreto/Fairly good
10	Sufficiente/Sufficient	Sufficiente/Sufficient	Sufficiente/Sufficient	Sufficiente/Sufficient
11	Sufficiente/Sufficient	Sufficiente/Sufficient	Sufficiente/Sufficient	Discreto/Fairly good
12	Sufficiente/Sufficient	Sufficiente/Sufficient	Sufficiente/Sufficient	Sufficiente/Sufficient
13	Sufficiente/Sufficient	Sufficiente/Sufficient	Sufficiente/Sufficient	Discreto/Fairly good
14	Insufficiente/Insufficient	Sufficiente/Sufficient	Sufficiente/Sufficient	Sufficiente/Sufficient
15	Sufficiente/Sufficient	Discreto/Fairly good	Discreto/Fairly good	Discreto/Fairly good
16	Sufficiente/Sufficient	Discreto/Fairly good	Discreto/Fairly good	Discreto/Fairly good
17	Sufficiente/Sufficient	Discreto/Fairly good	Discreto/Fairly good	Discreto/Fairly good
18	Sufficiente/Sufficient	Sufficiente/Sufficient	Sufficiente/Sufficient	Sufficiente/Sufficient
19	Sufficiente/Sufficient	Sufficiente/Sufficient	Sufficiente/Sufficient	Sufficiente/Sufficient
20	Sufficiente/Sufficient	Sufficiente/Sufficient	Sufficiente/Sufficient	Sufficiente/Sufficient
Media/ Average	1,85 Sufficiente/Sufficient	2,15 Sufficiente/Sufficient	2,30 Sufficiente/Sufficient	2,50 Discreto/Fairly good



α	0,05	Code	2
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							Significatività/ Significance
T0 - T14	n	6	T	0	T-crit	0	no
T0 - T28	n	9	T	0	T-crit	5	si/yes
T0 - T56	n	13	T	0	T-crit	17	si/yes

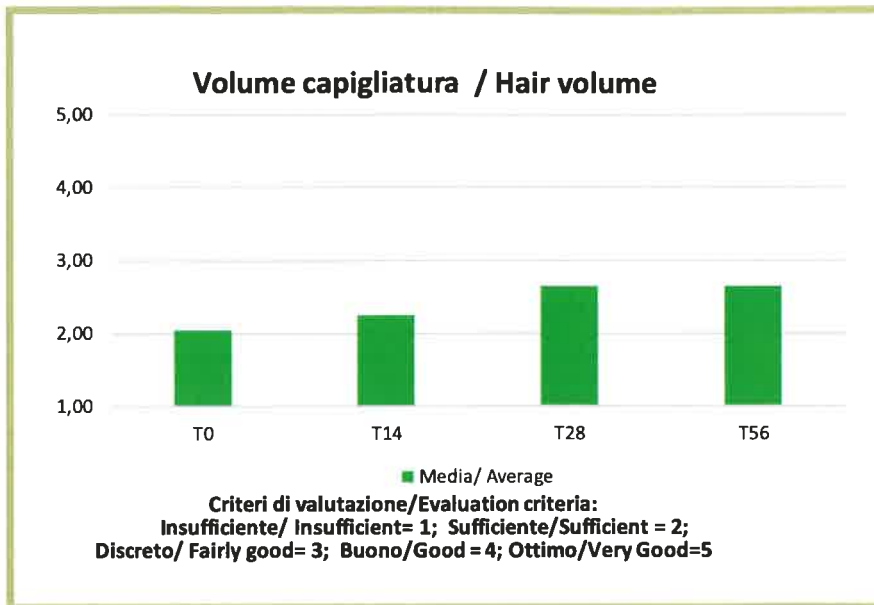
Overall hair condition improves in the:

40% of the panelists after 14 days of use (statistically significant)

45% of the panelists after 28 days of use (statistically significant)

65% of the panelists after 56 days of use (statistically significant)

Rif. Vol. Panelist code	Volume capigliatura / Hair volume			
	t0	t14	t28	t56
1	Sufficiente/Sufficient	Sufficiente/Sufficient	Sufficiente/Sufficient	Sufficiente/Sufficient
2	Sufficiente/Sufficient	Sufficiente/Sufficient	Discreto/Fairly good	Discreto/Fairly good
3	Sufficiente/Sufficient	Discreto/Fairly good	Discreto/Fairly good	Discreto/Fairly good
4	Sufficiente/Sufficient	Sufficiente/Sufficient	Sufficiente/Sufficient	Sufficiente/Sufficient
5	Insufficiente/Insufficient	Insufficiente/Insufficient	Insufficiente/Insufficient	Insufficiente/Insufficient
6	Insufficiente/Insufficient	Insufficiente/Insufficient	Sufficiente/Sufficient	Sufficiente/Sufficient
7	Sufficiente/Sufficient	Sufficiente/Sufficient	Sufficiente/Sufficient	Sufficiente/Sufficient
8	Sufficiente/Sufficient	Sufficiente/Sufficient	Sufficiente/Sufficient	Sufficiente/Sufficient
9	Discreto/Fairly good	Discreto/Fairly good	Buono/Good	Buono/Good
10	Sufficiente/Sufficient	Sufficiente/Sufficient	Sufficiente/Sufficient	Sufficiente/Sufficient
11	Sufficiente/Sufficient	Sufficiente/Sufficient	Discreto/Fairly good	Discreto/Fairly good
12	Insufficiente/Insufficient	Insufficiente/Insufficient	Insufficiente/Insufficient	Insufficiente/Insufficient
13	Discreto/Fairly good	Discreto/Fairly good	Discreto/Fairly good	Discreto/Fairly good
14	Insufficiente/Insufficient	Sufficiente/Sufficient	Sufficiente/Sufficient	Sufficiente/Sufficient
15	Discreto/Fairly good	Discreto/Fairly good	Buono/Good	Buono/Good
16	Sufficiente/Sufficient	Discreto/Fairly good	Discreto/Fairly good	Discreto/Fairly good
17	Discreto/Fairly good	Discreto/Fairly good	Buono/Good	Buono/Good
18	Sufficiente/Sufficient	Sufficiente/Sufficient	Discreto/Fairly good	Discreto/Fairly good
19	Discreto/Fairly good	Buono/Good	Buono/Good	Buono/Good
20	Sufficiente/Sufficient	Sufficiente/Sufficient	Discreto/Fairly good	Discreto/Fairly good
Media/ Average	2,05	2,25	2,65	2,65
	Sufficiente/Sufficient	Sufficiente/Sufficient	Discreto/Fairly good	Discreto/Fairly good



α	0,05	Code	2
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							Significatività/ Significance
T0 - T14	n	4	T	0	T-crit	--	no
T0 - T28	n	12	T	0	T-crit	13	si/yes
T0 - T56	n	12	T	0	T-crit	13	si/yes

Hair volume improves in the:

25% of the panelists after 14 days of use (no statistically significant)

60% of the panelists after 28 days of use (statistically significant)

60% of the panelists after 56 days of use (statistically significant)

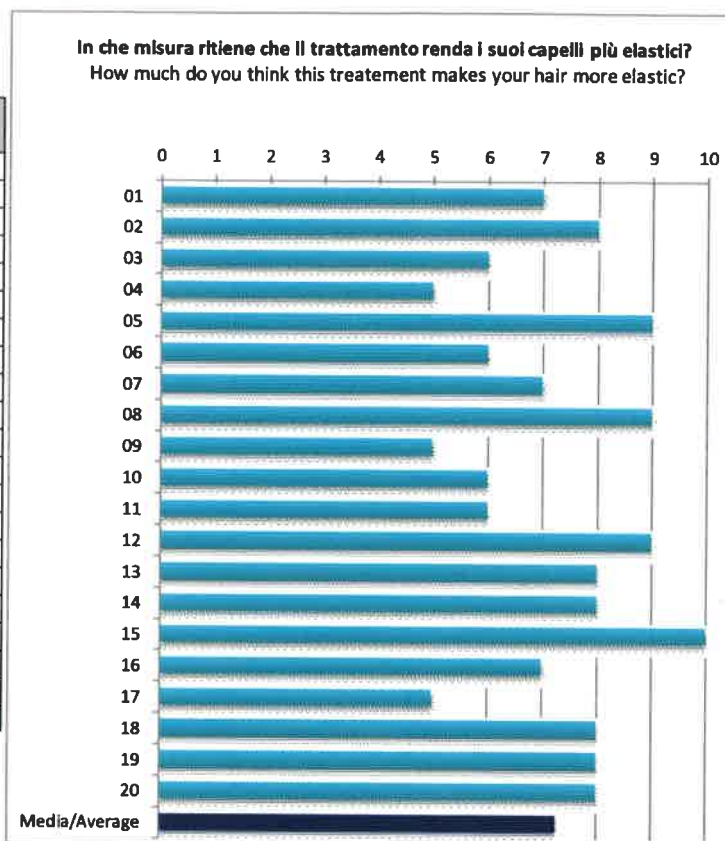
Analisi microscopica del capello - Microscopic hair analysis

Rif. Volontario Panellist code	T0	T14	OSSERVAZIONI/ OBSERVATIONS
	Analisi microscopica del capello - Microscopic hair analysis	Analisi microscopica del capello - Microscopic hair analysis	
1	Fusti secchi , alcune punte sfibrate e doppie / Dry hair shafts, some exhausted hair ends, some split ends	Fusti secchi , alcune punte sfibrate e doppie / Dry hair shafts, some exhausted hair ends, some split ends	nessuna variazione/ no variation
2	alcuni fusti secchi,alcune punte secche e sfibrate/ some dry hair shafts, some exhausted split ends	alcuni fusti secchi,alcune punte secche e sfibrate/ some dry hair shafts, some exhausted split ends	nessuna variazione/ no variation
3	Fusti secchi e opachi, alcune punte secche, sfibrate e doppie/ Dry and dull hair shafts, some dry and exhausted hair ends	Fusti secchi e opachi, alcune punte secche, sfibrate e doppie/ Dry and dull hair shafts, some dry and exhausted hair ends	nessuna variazione/ no variation
4	alcuni fusti e punte secchi, tricorrehi nodosa , altri nella norma/ some hair shafts and ends are dry/tricorrehi nodosa, others normal	alcuni fusti e punte secchi, tricorrehi nodosa , altri nella norma/ some hair shafts and ends are dry/tricorrehi nodosa, others normal	nessuna variazione/ no variation
5	punte sfibrate, doppie punte,fusti secchi/ dry hair ends, split ends, dry hair shafts	punte sfibrate, doppie punte,fusti secchi/ dry hair ends, split ends, dry hair shafts	nessuna variazione/ no variation
6	punte secche, fusti secchi/ dry hair ends and dry hair shafts	punte secche, fusti secchi/ dry hair ends and dry hair shafts	nessuna variazione/ no variation
7	alcune punte sfibrate e doppie, fusti secchi e opachi/ some dry and split hair ends, dry and dull hair shafts	alcune punte sfibrate e doppie, fusti secchi e opachi/ some dry and split hair ends, dry and dull hair shafts	nessuna variazione/ no variation
8	punte secche, fusti leggermente secchi/ dry hair ends and slightly dry hair shafts	punte secche, fusti leggermente secchi/ dry hair ends and slightly dry hair shafts	nessuna variazione/ no variation
9	punte sfibrate, doppie punte,fusti secchi/ dry hair ends, split ends, dry hair shafts	minore quantità di punte sfibrate e doppie , fusti leggermente secchi/less dry hair ends, split ends, less dry hair shafts	nessuna variazione/ no variation
10	punte sfibrate, doppie punte,fusti secchi/ dry hair ends, split ends, dry hair shafts	punte sfibrate, doppie punte,fusti secchi/ dry hair ends, split ends, dry hair shafts	nessuna variazione/ no variation
11	capelli molto fini, fusti leggermente secchi, presenza di doppie punte e punte secche/ very thin hair, slightly dry hair shafts, presence of dry and split ends	capelli molto fini, fusti leggermente secchi, presenza di doppie punte e punte secche/ very thin hair, slightly dry hair shafts, presence of dry and split ends	nessuna variazione/ no variation
12	alcune punte sfibrate, fusti secchi / some dry and split hair ends, dry and dull hair shafts	alcune punte sfibrate, fusti secchi / some dry and split hair ends, dry and dull hair shafts	nessuna variazione/ no variation
13	punte sfibrate, fusti secchi/ dry hair ends,dry hair shafts	punte sfibrate, fusti secchi/ dry hair ends,dry hair shafts	nessuna variazione/ no variation
14	doppie punte, fusti secchi/split ends and dry hair shafts	doppie punte, fusti secchi/split ends and dry hair shafts	nessuna variazione/ no variation
15	doppie punte, fusti secchi/split ends and dry hair shafts	doppie punte, fusti secchi/split ends and dry hair shafts	nessuna variazione/ no variation
16	punte sfibrate, doppie punte,fusti secchi/ dry hair ends, split ends, dry hair shafts	punte sfibrate, doppie punte,fusti secchi/ dry hair ends, split ends, dry hair shafts	nessuna variazione/ no variation
17	fusti secchi, tricorrehi nodosa ,punte sfibrate/ dry hair shafts, tricorrehi nodosa,dry hair ends	fusti secchi, punte sfibrate/ dry hair shafts, dry hair ends	nessuna variazione/ no variation
18	punte sfibrate, alcune doppie punte, fusti leggermente secchi/ dry hair ends, split ends, slightly dry hair shafts	punte sfibrate, fusti leggermente secchi/ dry hair ends, slightly dry hair shafts	nessuna variazione/ no variation
19	punte sfibrate, doppie,fusti leggermente secchi/split and dry hair ends, slightly dry hair shafts	punte sfibrate, doppie,fusti leggermente secchi/split and dry hair ends, slightly dry hair shafts	nessuna variazione/ no variation
20	alcune punte sfibrate e doppie, fusti leggermente secchi e opachi/ some dry and split hair ends, slightly dry and dull hair shafts	alcune punte sfibrate e doppie, fusti leggermente secchi e opachi/ some dry and split hair ends, slightly dry and dull hair shafts	nessuna variazione/ no variation

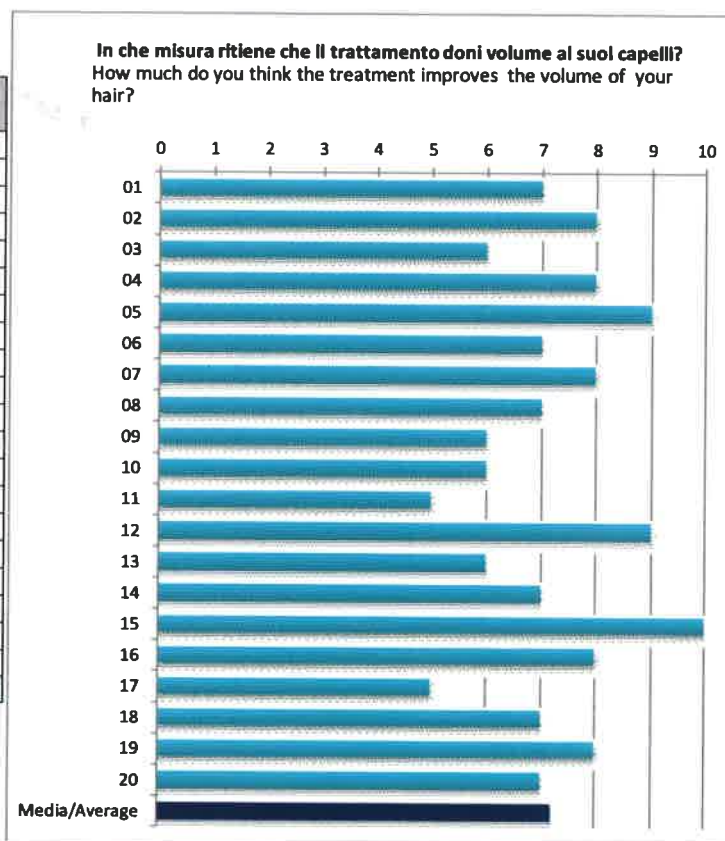
T28		T56	
Analisi microscopica del capello - Microscopic hair analysis	OSSERVAZIONI/ OBSERVATIONS	Analisi microscopica del capello - Microscopic hair analysis	OSSERVAZIONI/ OBSERVATIONS
Fusti secchi , alcune punte sfibrate e doppie / Dry hair shafts, some exhausted hair ends, some split ends	nessuna variazione/ no variation	Fusti più idratati, alcune punte sfibrate / hair shafts more hydrated, some exhausted split ends	miglioramento/ improvement
alcuni fusti secchi,punte nella norma/ some dry hair shafts, normal hair ends	miglioramento/ improvement	alcuni fusti secchi,punte nella norma/ some dry hair shafts, normal hair ends	miglioramento/ improvement
fusti meno secchi , alcune punte nella norma/ hair shafts more hydrated, some normal hair ends	miglioramento/ improvement	fusti nella norma , alcune punte nella norma/ hair shafts more hydrated, some normal hair ends	miglioramento/ improvement
fusti più luminosi , presenza di punte secche / hair shafts brighter , dry hair ends	miglioramento/ improvement	fusti più luminosi , presenza di punte secche / hair shafts brighter , dry hair ends	miglioramento/ improvement
alcune punte sfibrate, fusti più idratati, alcune doppie punte/ some dry hair ends, some split ends, hair shafts more hydrated	miglioramento/ improvement	alcune punte sfibrate, fusti più idratati/ some dry hair ends, hair shafts more hydrated	miglioramento/ improvement
punte secche, fusti secchi/ dry hair ends and dry hair shafts	nessuna variazione/ no variation	punte secche, fusti poco secchi/ dry hair ends and slightly dry hair shafts	miglioramento/ improvement
alcune punte sfibrate e doppie, fusti più luminosi e idratati/ some dry and split hair ends, more hydrated and bright hair shafts	miglioramento/ improvement	alcune punte sfibrate e doppie, fusti più luminosi e idratati/ some dry and split hair ends, more hydrated and bright hair shafts	miglioramento/ improvement
punte secche, fusti leggermente secchi/ dry hair ends and slightly dry hair shafts	nessuna variazione/ no variation	punte secche, fusti leggermente secchi/ dry hair ends and slightly dry hair shafts	nessuna variazione/ no variation
minore quantità di punte sfibrate e doppie , fusti leggermente secchi/less dry hair ends, split ends, less dry hair shafts	miglioramento/ improvement	minore quantità di punte sfibrate e doppie , fusti leggermente secchi/less dry hair ends, split ends, less dry hair shafts	miglioramento/ improvement
minore quantità di punte sfibrate e doppie , fusti leggermente secchi/less dry hair ends, split ends, less dry hair shafts	miglioramento/ improvement	minore quantità di punte sfibrate e doppie , fusti leggermente secchi/less dry hair ends, split ends, less dry hair shafts	miglioramento/ improvement
fusti leggermente secchi, minore presenza di doppie punte e punte meno secche/ slightly dry hair shafts, less quantity of split ends, less dry hair ends	miglioramento/ improvement	fusti leggermente secchi, minore presenza di doppie punte e punte meno secche/slightly dry hair shafts, less split ends and dry hair ends	miglioramento/ improvement
alcune punte sfibrate, fusti secchi / some dry and split hair ends, dry and dull hair shafts	nessuna variazione/ no variation	alcune punte sfibrate, fusti secchi / some dry and split hair ends, dry and dull hair shafts	nessuna variazione/ no variation
punte meno sfibrate, fusti meno secchi/ less dry hair ends,less dry hair shafts	miglioramento/ improvement	punte meno sfibrate, fusti meno secchi/ less dry hair ends,less dry hair shafts	miglioramento/ improvement
doppie punte e sfibrate, fusti nella norma/ split ends and normal hair shafts	miglioramento/ improvement	doppie punte e sfibrate, fusti nella norma/ split ends and normal hair shafts	miglioramento/ improvement
doppie punte, fusti meno secchi/split ends and less dry hair shafts	miglioramento/ improvement	doppie punte, fusti meno secchi/ split ends and less dry hair shafts	miglioramento/ improvement
punte leggermente secche, fusti leggermente secchi/ slightly dry hair ends, slightly dry hair shafts	miglioramento/ improvement	punte leggermente secche, fusti normali/ slightly dry hair ends, normal hair shafts	miglioramento/ improvement
fusti secchi, alcune punte sfibrate/ dry hair shafts, some dry hair ends	miglioramento/ improvement	fusti meno secchi, alcune punte sfibrate/less dry hair shafts, some dry hair ends	miglioramento/ improvement
alcune punte sfibrate, fusti nella norma/ some dry hair ends, normal hair shafts	miglioramento/ improvement	alcune punte sfibrate, fusti nella norma/ some dry hair ends, normal hair shafts	miglioramento/ improvement
fusti nella norma, alcune punte sfibrate/ normal hair shafts, some dry hair ends	miglioramento/ improvement	fusti nella norma, alcune punte sfibrate/ normal hair shafts, some dry hair ends	miglioramento/ improvement
alcune punte sfibrate e doppie, fusti leggermente secchi e opachi/ some dry and split hair ends, slightly dry and dull hair shafts	nessuna variazione/ no variation	alcune punte sfibrate e doppie, fusti leggermente secchi e opachi/ some dry and split hair ends, slightly dry and dull hair shafts	nessuna variazione/ no variation

→ Self-evaluations

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Media/Ave.	7,25

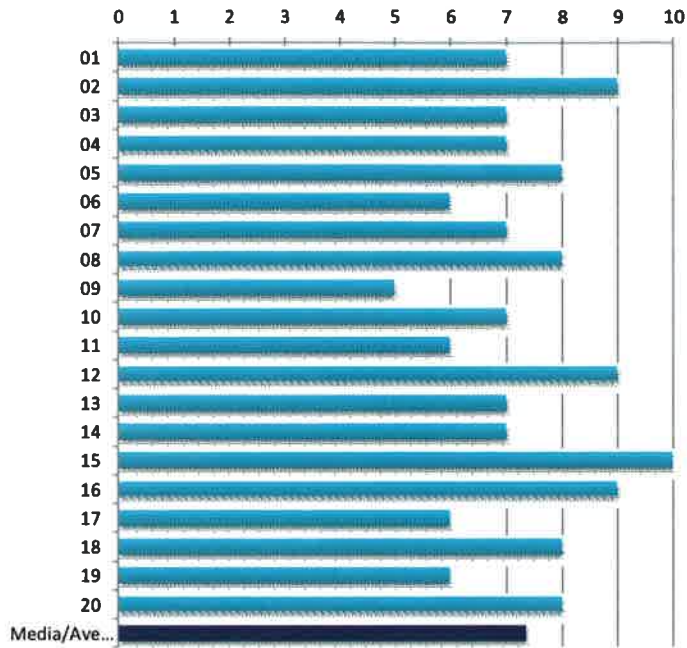


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Media/Ave.	7,20



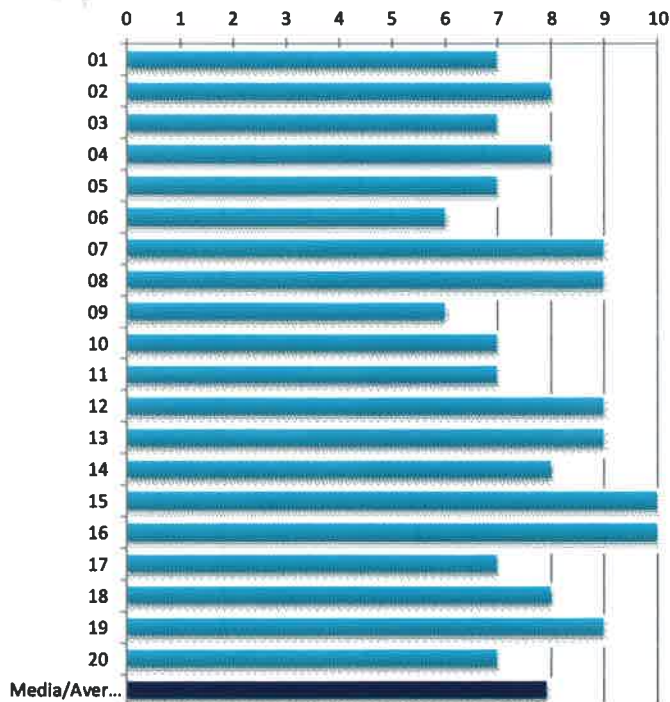
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Media/Ave.	7,35

In che misura ritiene che il trattamento DONI LUCENTEZZA ai suoi capelli/renda i capelli più brillanti?
 How much do you think the treatment gives shine to your hair/makes your hair brighter?

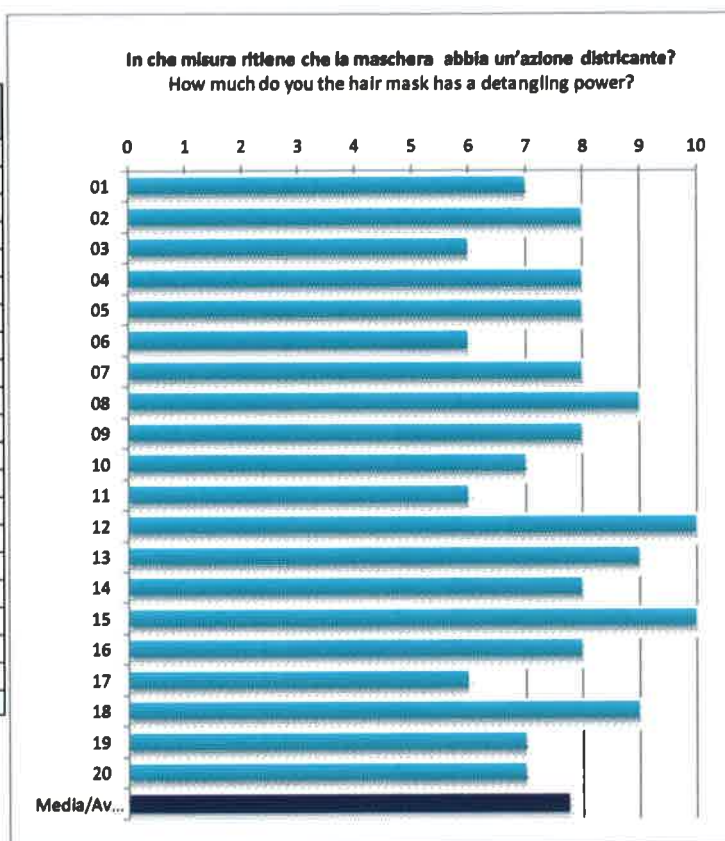


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Media/Ave.	7,90

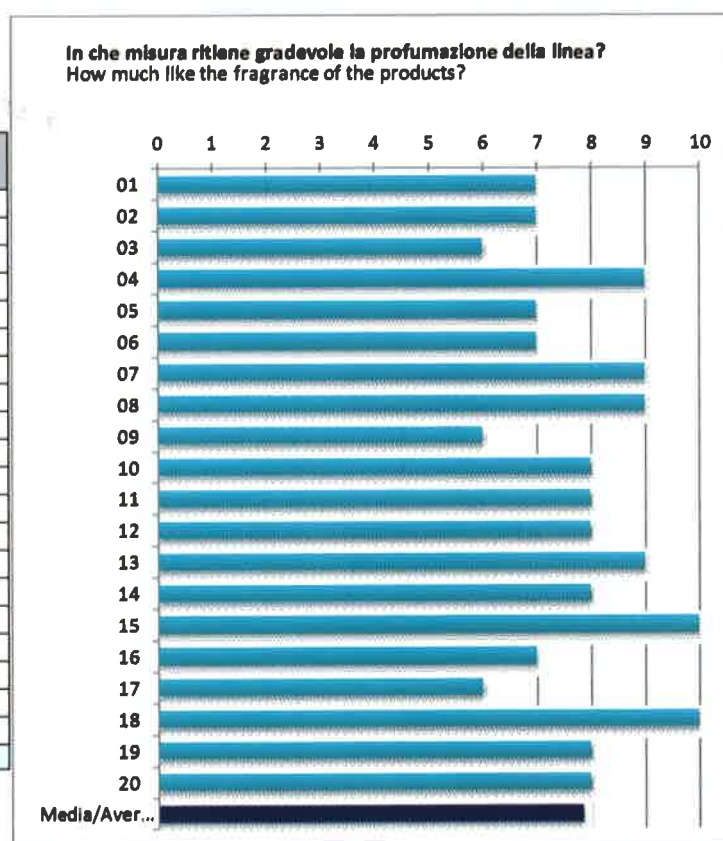
In che misura ritiene che il trattamento svolga efficace azione detergente?
 How much do you think the product has a good cleansing system?



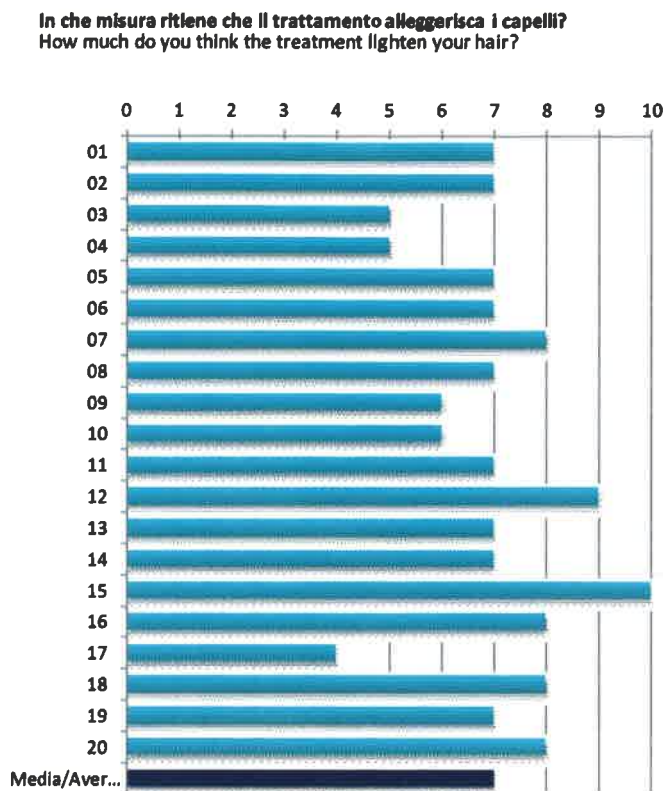
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Media/Ave.	7,75



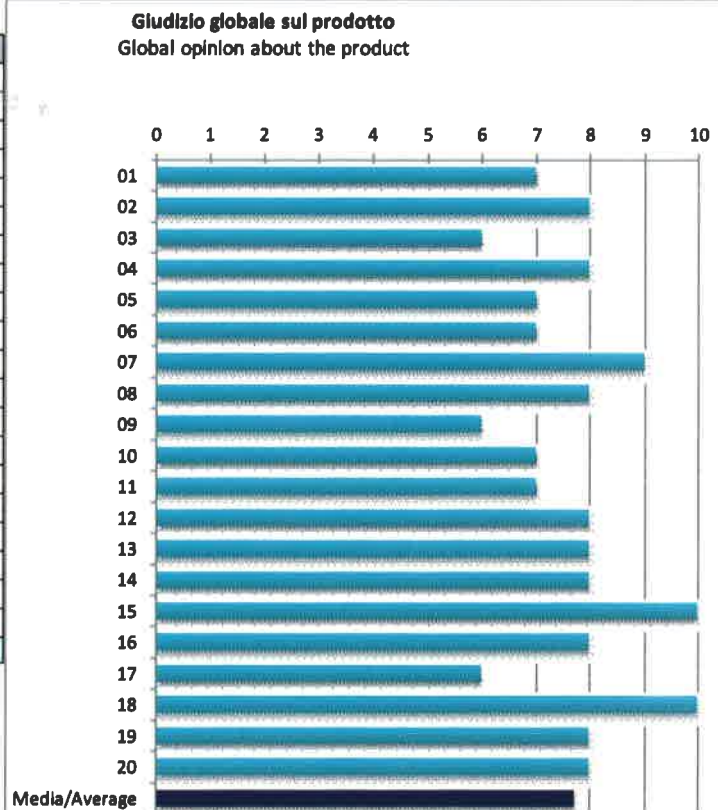
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Media/Ave.	7,85



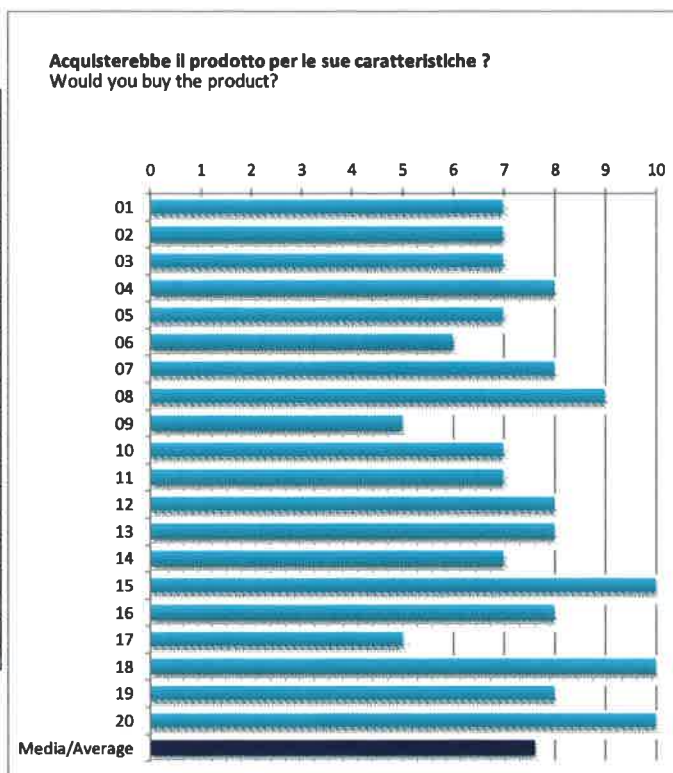
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Media/Ave.	7,00



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Media/Ave.	7,60



CONCLUSIONS

According to the obtained results we can state that the cosmetic treatment based on Glixina complex in the volunteers who underwent the clinical test, has proved to have an effect improving hair resistance to breakage, hair volume, overall hair condition and in reducing the split ends presence.

The treatment has also proved to have a good acceptability in use and it has been showed an high level of compliance by the volunteers.

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