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Photon emission of the human body (biophotons) and perceived well-being

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Abstract: Photons emitted by the human body are called biophotons. Multiple types of research show that this kind of electromagnetic emission can help science improve knowledge on the status of biological systems and human health. This study aims at investigating the emission of biophotons in relation to perceived well-being. To analyse this relation, the emission of biophotons was measured using a digital camera, called Mira HIS, while Profile of Mood State (POMS) and SF-36 tests were administered to study the health status of the participants. 311 people were enrolled in total. Data show a moderately inverse correlation between the consistency indicator of biophotons and the domains of the POMS aggression/anger and total mood disturbance

Key words: biophoton emission; well-being; psychological state; biophotons.

Introduction

Photons are characterized by electromagnetic quanta interacting between electrical charges such as electrons or electrical aggregations like atoms, molecules, and macromolecules[1]. This phenomenon affects biological systems and has been named in several ways, i.e., spontaneous chemiluminescence and ultraweak photon emission (UPE), either spontaneous or induced[2]. Spontaneous UPE has an intensity of 10 to several hundred photons per second per square centimeter[2]. Since the 1920s, scientific studies on human body UPE (biophotons) have multiplied. Cohen and Popp[3] illustrated that the study of the biophoton emissions may represent a new and non-invasive method to analyse cell tissues and, in general, to monitor the health and diseases of human beings. Researchers showed that healthy people have a relatively low biophoton emission, unlike sick people, who show rather high UPE values instead and notable asymmetries between the right and left side of the body[4]. Likewise, Michal Cifra and Pavel Pospíšil, studying the current literature, concluded that the analysis of this phenomenon may be used for monitoring the physiological state of biological systems[2]. Some authors argued that the presence of free radicals or reactive oxygen species (ROS), is related to the presence of UPE. ROS play a key role in the development of infections, apoptosis, ageing, and cell communication[5,6]. Experimental evidence showed that different biophotons reflect different physiological processes and biological functions[7,8,9,10]. Due to the importance of the biologically generated fields (biofields) on health and human life, Richard Hammerschlag and colleagues proposed biofield physiology as a viable scientific discipline[11]. The study of this phenomenon is based on scientific knowledge deriving from different areas and requires a particular technology, i.e., sufficiently sensitive optical detectors to measure this type of radiation[12,13,14]. Light detectors allowing images of biophotons to be monitored over time are nowadays available. In particular, arrays of Charged Coupled Devices (CCDs) are used as detectors in video cameras X-UV-visible IR bands for being low-noise, high sensitivity and excellent angular resolution. Creath and Schwartz revised their studies on technologies to study the biophotons and they argued that monitoring biofields would lead to relevant conclusions on health status and healing processes. For instance, the findings from their studies showed how physiological processes are successfully monitored by bio-photon imaging instruments, providing quantitative information on the organism health status, and thereby allowing significant conclusions[7]. Kobayashi et al. showed that fluctuations in UPE are correlated with specific cerebral blood flow and cerebral energy metabolism[15]. Takeda and colleagues used this technique to study cancer development and found that biophoton emission intensity reflects the viability of the tumour tissue[16]. It would seem that systematic measurement of ultra-low photon emissions may enable a deeper understanding of health state and that it might be an extremely effective non-invasive analysis tool. Furthermore, Van Wijk et al. carried out interesting research on the correlation between biophotons and Meditation. This mind-body practice can influence the psychophysical state of a subject and, probably, UPE as a consequence[17,18,19,20]. Results showed that Meditation may affect the emission of biophotons. Despite the growing number of studies on this topic, no research has investigated mental health in relation to the emission of biophotons yet. Based on these assumptions, this study was conducted to correlate the perceived state of well-being with the emission of biophotons captured with a digital camera.

Materials and Methods

The diagnostic accuracy study carried out in the area of the Local Health Authority of Bologna (LHAB) started in July 2017 and ended in November 2018. The LHAB area covers most of the Metropolitan Area of Bologna, Northern Italy, serving around 890 thousand inhabitants. The study was approved by the Ethics Committee and all procedures were performed in compliance with the 1964 Declaration of Helsinki. The study population was randomly selected from the archive of LHAB patients (Health Registry) as updated on 01.06.2017. Citizens residing in Bologna, between 18 and 69 years of age and having a telephone number entered in the registry were contacted by telephone. After being given a presentation and details of the objectives and methods, researchers invited them to participate in the study. An appointment was arranged for those willing to provide more information and to

sign an informed consent. This was followed by the administration of the questionnaires and the detection of biophoton emissions performed on the same day. Each participant completed the quality-of-life assessment questionnaire (SF-36)[22] and the Profile of Mood States (POMS)[23]. The SF-36 is made of 36 questions referring to eight fields (physical activity, role limitations due to physical health, physical pain, perception of general health, vitality, social activities, role and emotional state and mental health). The overall scores allowed for the construction of two indices of the health state, one related to physical state (Physical component summary - Pcs) and the other to the psychological one (Mental component summary-Mcs). The POMS questionnaire is made of 65 items assessing 6 affective domains: tension/anxiety, depression/dejection, aggression/anger, vigour/activity, fatigue/indolence and confusion/bewilderment. The total mood disorder (TMD) score was calculated from the individual scores of the 6 domains by subtracting the positive mood scale (vigour) from the negative mood scales (tension/anxiety, depression, anger/hostility, fatigue and confusion). The TMD is an indicator of "general distress", with higher scores indicating a higher degree of mood disturbance. The participants were subjected to the detection of biophoton emissions using a digital camera called Mira HSI in the prototype version, and Cora HSI, in a subsequent version, and a software for the acquisition of RAW data and subsequent analysis. The data related to the measurement of biophotons are obtained from the indexes of arbitrary variation of pixels from 0 to 255; the differential signals of photon increment are amplified with an N-fold magnification algorithm. In order to capture the images and make them viewable on a graph, these are normalized with values from 0 to 1. All subjects were asked to wear a light blue monochromatic coat, to have a homogeneous surface in all subjects, avoiding any particular reflections depending on different types of fabrics and colours. These tests were performed in a room inside the Bellaria Hospital. For the evaluation of photon intensity, an ADU (Analogical Digital Unity) photon-count system was used, providing a reading of the photoelectrons captured by the sensor. For a correct evaluation of light, we developed an automatic calibration related to illumination with natural light, even if it should be repeated every time before the measurement. We assessed the coherence of emission as the distribution on the pixel matrix of the colour indices of brightness, magnitude and polarization. We considered higher coherence in case of more linear and fewer quantum fluctuations, i.e., greater balance and stability of the acquired measurement. The consistency expressed in the measurements also indicates how stable the subject is while standing in relation to the centre of gravity and any microtremors, potential indicators of an altered state (tension / anger / nervousness). Poor coherence or low photon emissivity can be an indicator of particular psychophysiological status that may be present, for example, in depressed subjects. The Mira and Cora machines are multispectral and hyperspectral optoelectronic devices with 1 or more sensors working simultaneously in different spectral bands. The energy differences recorded over time in each band of scattered photon emission contribute to the statistical evaluation of biophoton-scattering and to the decoding of psycho-emotional states.

Statistics

A descriptive analysis of all variables was conducted. Continuous variables are presented as mean and standard deviation, categorical variables as absolute and relative frequency.

Pearson's correlation coefficient was used to assess whether there is a correlation between the POMS indicators, SF-36 questionnaires and the coherence indicator. Sensitivity, specificity, positive and negative predictive value as well as the receiver operating characteristic curve (ROC curve) were calculated to compare the coherence indicator with the POMS, our gold standard, whose results were transformed into dichotomous variables. Scores ≥60 were considered to be the expression of clinically significant psychological distress except for the Vigour scale where scores ≤40 were considered to be clinically relevant. The analyses were also stratified by age, gender, marital status and education.

All statistical analyses were conducted using Stata Intercooled for Windows, version 16 and P values below 0.05 were considered to be significant.

Results

2,349 residents aged 18-69 were extracted from the health register; 2,075 people were contacted to partake in the study: 1,764 refused for organizational and work reasons (Figure 1). In total, 311 people were enrolled, 175 (56.3%) females and 136 (43.7%) males with an average age of 49, 62.8% of the sample is married /

cohabitant and 44.7% holds a university degree (table 1).

There is a moderate inverse correlation [according to Guilford's interpretation (24)] between the coherence indicator and the domains of the POMS aggression / anger and total mood disturbance (table 2). The analysis stratified by gender, age, marital status and education shows that these correlations are higher in males (aggression / anger: ρ = -0.53; TMD: ρ = -0.46), in younger groups (aggression/anger: 18-36 years ρ = -0.62, TMD: 18-36 and 37-54 years ρ = -0.52), in those who are unmarried / cohabiting (aggression / anger: ρ = -0. 54; TMD: ρ = -0.62) and in university graduates (aggression / anger: ρ = -0.47; TMD: ρ = -0.52). The correlation between biophoton emissions and the indices of the SF-36 questionnaire are insignificant instead or, in any case, low.

Table 3 shows the diagnostic accuracy values of the coherence with respect to the POMS after a transformation into dichotomous variables. Sensitivity values above 80% are observed in the domains of tension / anxiety, aggression / anger and total mood disturbance of the POMS. Specificity, on the other hand, shows values below 62%. Males, young people aged between 18 and 36 years have sensitivity values exceeding 90% for the aggression / anger and total mood disturbance domains of the POMS, with an index around 80% of the Roc curve.

Conclusion

A systematic review of literature confirmed that the development of research on the study of biophotons has increased over the past 50 years; furthermore, it is emphasized that the studies on this subject are carried out through high-quality research, confirming the increasingly widespread use of biophotons in the study of health status[7,21].

The data from this study related to the psychophysical state to the emission of biophotons. The interesting element concerns an inverse correlation between biophoton emission and the index represented by anger/aggression and total mood disturbances, especially in males and young people, singles and graduates. In the light of the literature in this scientific field, this study shows that UPE may contribute to the evaluation of wellbeing[16,17], particularly in case of anger or general distress. Stress can also affect UPE, both internally and externally[25].

The instrument used for the detection of biophotons has shown a high sensitivity; therefore, this tool could be very valuable during the initial stages of a series of assessments, while, for subsequent assessments, it would be more appropriate to use other tools, as well as to make the surveys more robust.

Appendix

	n(%)	*Mean (sd)*
Gender		
F	***175(56.3)***	
M	***136(43.7)***	
Age (years)		***49(12.3)***
*Marital Status**		
Unmarried	***72 (25)***	
Married / cohabiting	***181(62.8)***	
Separated / divorced	***29 (10.1)***	
Widower	***6 (2.1)***	
*Education level**		
Primary school	***6 (2.0)***	
Secondary school	***34 (1.,3)***	
High School	***127(42.0)***	
University degree	***135(44.7)***	
SF-36		

Physical activity		***90.8(14.7)***
*Role and physical health **		***81.5(31.5)***
*Physical pain **		***75.0(23.4)***
*Health in general **		***65.6(18.8)***
*Vitality**		***59.6(17.8)***
*Social activities **		***70.9(22.9)***
*Emotional state**		***74.1(35.2)***
*Mental health**		***68.8(16.6)***
*Physical health**		***53.1 (9.2)***
*Total Mental health **		***38(15.3)***
SF-36 – Health (1 year before testing)		
Much better	***15 (4.8)***	
A little better	***48 (15.4)***	
Same	***202(65)***	
A little worse	***41 (13.2)***	
Much worse	***5 (1.6)***	
POMS		
*Tension / anxiety **		***48.9 (9.4)***
*Depression / Depression **		***71.5(17.9)***
*Aggression / Anger **		***67.8(20.6)***
*Strength / Activity **		***54.9(10.1)***
*Tiredness / Indolence **		***51,9(10,6)***
*Confusion / Bewilderment **		***48,1(10,5)***
*Total Mood Disturbance **		***233,8(37,7)***
Coherence		***65.9 (6.9)***

****missing data***

Table 1. Socio-demographic, psychological and health characteristics.

	Rho Coefficient	**p-value**
SF-36		
Physical activity	0.03	0.642
Role and physical health *	0.04	0.507
Physical pain *	-0.04	0.434
Health in general *	0.09	0.107
Vitality*	0.06	0.276
Social activities *	0.08	0.150
Emotional state*	0.07	0.232
Mental health*	-0.03	0.622
Physical health*	0.02	0.765
Total Mental health *	0.04	0.457
POMS		
Tension / anxiety *	-0.08	0.170
Depression / Depression *	-0.19	0.001
Aggression / Anger *	-0.43	0.000
Strength / Activity *	0.11	0.055

Tiredness / Indolence *	-0.12	0.032
Confusion / Bewilderment *	-0.14	0.017
Total Mood Disturbance	-0.46	0.000

Table 2. Correlation between coherence and SF-36 and POMS' indicators

	Sensitivity	Specificity	PPV	NPV	ROC
All					
Tension / anxiety	82.05	44.36	17.78	94.40	56.00
Depression / Depression	68.95	55.86	72.78	51.24	62.00
Aggression / Anger	81.25	61.78	66.10	78.23	72.00
Strength / Activity	68.69	45.59	37.99	75.00	56.00
Tiredness / Indolence	63.16	44.12	46.93	60.48	53.71
Confusion / Bewilderment	67.62	45.18	39.66	72.36	56.00
Total Mood Disturbance	81.21	61.83	70.76	74.31	72.54
Females					
Tension / anxiety	80.77	49.66	22.34	93.51	57.92
Depression / Depression	66.35	60.94	73.40	52.70	63.05
Aggression / Anger	72.94	62.07	65.26	70.13	67.70
Strength / Activity	60.66	48.15	39.78	68.42	54.10
Tiredness / Indolence	58.23	47.83	48.94	57.14	53.04
Confusion / Bewilderment	64.62	49.51	44.68	68.92	56.80
Total Mood Disturbance	72.22	62.69	72.22	62.69	67.45
Males					
Tension / anxiety	84.62	38.02	12.79	95.83	54.31
Depression / Depression	72.09	48.94	72.09	48.94	60.51
Aggression / Anger	93.22	61.43	67.07	91.49	79.28
Strength / Activity	81.58	42.71	36.05	85.42	60.73
Tiredness / Indolence	70.37	39.74	44.71	65.96	55.33
Confusion / Bewilderment	72.50	40.43	34.12	77.55	55.83
Total Mood Disturbance	94.92	60.94	69.14	92.86	81.00
18-36 years					
Tension / anxiety	87.50	34.88	20.00	93.75	56.88
Depression / Depression	82.76	50.00	70.59	66.67	68.63
Aggression / Anger	92.86	63.86	76.47	87.50	57.23
Strength / Activity	76.19	36.67	45.71	68.75	81.99
Tiredness / Indolence	70.37	34.78	55.88	50.00	52.94
Confusion / Bewilderment	73.08	36.00	54.29	56.25	55.27
Total Mood Disturbance	89.29	63.16	78.12	80.00	79.06
37-54 years					
Tension / anxiety	85.71	46.03	20.93	95.08	58.01
Depression / Depression	67.71	58.49	74.71	50.00	62.36
Aggression / Anger	83.58	62.96	65.12	82.26	60.41
Strength / Activity	76.19	48.57	37.21	83.61	73.69
Tiredness / Indolence	66.18	48.1	52.33	62.3	57.31
Confusion / Bewilderment	71.74	47.06	37.93	78.69	58.31
Total Mood Disturbance	82.61	63.89	68.67	79.31	73.99
55-71 years					
Tension / anxiety	70.00	46.39	11.86	93.75	52.81
Depression / Depression	64.62	55.26	71.19	47.73	59.46
Aggression / Anger	71.43	59.26	61.40	69.57	50.22
Strength / Activity	55.56	44.93	34.48	65.96	65.48
Tiredness / Indolence	52.63	42.65	33.90	61.70	47.80
Confusion / Bewilderment	57.58	45.71	33.33	69.57	51.45
Total Mood Disturbance	75.00	57.50	69.64	63.89	66.77

Table 3. Sensitivity, specificity, positive (PPV) and negative (NPV) predictive value and ROC curve

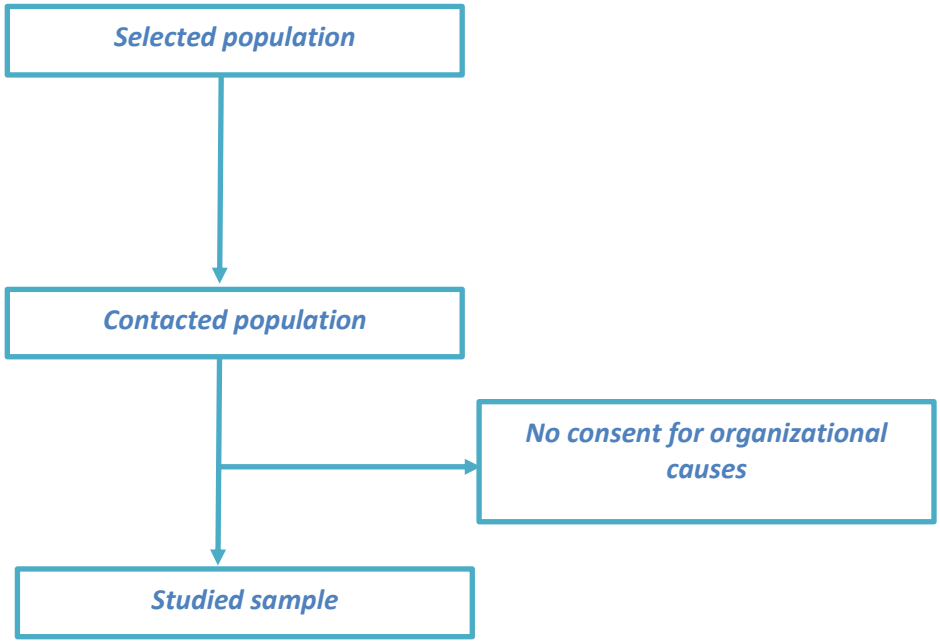

Figure 1. Flowchart of study participants.

References

1. *Grass F, Klima H, Kasper S. Biophotons, microtubules and CNS, is our brain a "holographic computer?" Med Hypotheses. 2004;62: 169-172*
2. *Cifra M, Pospíšil P. Ultra-weak photon emission from biological samples: definition, mechanisms, properties, detection and applications. J Photochem Photobiol B. 2014 Oct 5;139:2-10. doi: 10.1016/j.jphotobiol.2014.02.009. Epub 2014 Feb 20. PMID: 24726298.*
3. *Cohen S, Popp FA. Biophoton emission of human body. Indian J. Exp Biol., 2003; 41(5):440-5.*
4. *Hammerschlag R, Levin M, McCraty R, et al. Biofield Physiology: A Framework for an Emerging Discipline. Glob Adv Health Med. 2015;4(Suppl):35-41. doi:10.7453/gahmj.2015.015.suppl*
5. *Pospıs˘il P, Prasad A, Ra´c M. Role of reactive oxygen species in ultra-weak photon emission in biological systems. J Photochem Photobiol B. 2014;139:11-23.*
6. *Usui S, Tada M, Kobayashi M. Non-invasive visualization of physiological changes of insects during metamorphosis based on biophoton emission imaging. Sci Rep.2019; 9, 8576 (). https://doi.org/10.1038/s41598-019-45007-3*
7. *Ives JA, Van Wijk EP et al. Ultraweak photon emission as a non-invasive health assessment: a systematic review. Plos One. 2014; 28;9(2).*
8. *Cifra M, Van Wijk et al. Spontaneous Ultra-Weak Photon Emission from Human Hands is time dependent. RadioEngineering. 2007; Vol 16, NO.2.*
9. *Van Wijk EP, Kobayashi M et al. Imaging of ultra-weak photon emission in a rheumatoid arthritis mouse model. Plos One, 2013 Dec 30; 8(12).*
10. *Bajpai RP, Van Wijk EP et al. Attributes characterizing spontanous ultra-weak photon signals of human subjects. J.Photochem Photobiol.B.2013 Dec 5;129:6-16.*
11. *Engstrom RW. Multiplier photo-tube characteristics, Application to low light levels. JOSA37. 1947; (6): 420-431. 13.*
12. *Morton GA, and Mitchell JA. RCA Review 1948; 9: 632*
13. *Westoo R, Wiedling T. Investigations of the pulse-distribution of an RCA multiplier phototube. ArkivFysik 1949; 1.*
14. *Creath K, & Schwartz GE. What biophoton images of plants can tell us about biofields and healing, Journal of Scientific Exploration. 2005;19(4): 531-550.*
15. *Kobayashi M, Takeda M, Sato T et al. In vivo imaging of spontaneous ultra-weak photon emission from a rat's brain correlated with cerebral energy metabolism and oxidative stress. Neurosci Res. 1999;34(2):103–13.*
16. *Takeda M, Kobayashi M, Takayama M, Suzuki S, Ishida T, Ohnuki K, Moriya T, Ohuchi N. Biophoton detection as a novel technique for cancer imaging. Cancer Sci. 2004 Aug;95(8):656-61. doi: 10.1111/j.1349-7006.2004.tb03325.x. PMID: 15298728.*
17. *Van Wijk EP, Lutke R et al. Differential effects of relaxation techniques on ultraweak photon emission. J.Altern.Complement. Med, 2008 April; 14(3):241-250.*
18. *Pagliaro G, Pelati R, Signorini D, Parenti G, & Roversi F. The effects of meditation on the performance and well-being of a company: A pilot study. EXPLORE, 2020;16(1), 56-60.*
19. *Pagliaro G, Pandolfi P, Collina N, Frezza G, Brandes A, Galli M et al. A randomized controlled trial of tong len meditation practice in cancer patients: Evaluation of a distant psychological healing effect. EXPLORE, 2016;12(1), 42-49.*
20. *Pagliaro G, Mandolesi N, Parenti G, Marconi L, Galli M, Sireci, F and Agostini E. Human Bio-Photons Emission: an observational Case Study of Emission of Energy Using a Tibetan Meditative Practice on an Individual. BAOJ Physics 2017;2: 025.*
21. *Calcerrada M, Garcia-Ruiz C. Human Ultraweak Photon Emission: Key Analytical Aspects, Results and Future Trends - A Review. Crit Rev Anal Chem. 2019;49(4):368-381. doi: 10.1080/10408347.2018.1534199. Epub 2018 Dec 24. PMID: 30582823.*
22. *Brazier JE, Harper R, Jones NMB, O'Cathain A, Thomas KJ, Usherwood T, Westlake L. Validating the SF-36 health survey questionnaire: new outcome measure for primary care. BMJ. 1992;305:160-4.*

23. *McNair, Lorr M, Droppleman L. Profile of Mood States Manual. North Tonawanda, NY:Multi-HealthSystems. 1992*
24. *Guilford JP. Fundamental statistics in psychology and education. New York, NY: McGraw-Hill. Huwari, I. F., & A. 1973*
25. *Zapata F, Pastor-Ruiz V, Ortega-Ojeda F, Montalvo G, Ruiz-Zolle AV, García-Ruiz C. Human ultra-weak photon emission as non-invasive spectroscopic tool for diagnosis of internal states – A review. Journal of Photochemistry and Photobiology B: Biology.2021; Volume 216,112141,ISSN1011-1344, https://doi.org/10.1016/j.jphotobiol.2021.112141.*