A Pilot Study Using AI for Psychology:
ABO Blood Type and Personality Traits

Masayuki Kanazawa

Human Sciences ABO Center, Tokyo, Japan

Abstract   The relationship between blood type and personality has long been one of the more challenging issues of scientific studies. Several large-scale surveys were conducted to address the issue, and some of them had shown statistically significant associations. Presently, more than half of Japanese people feel that the relationship is legitimate. This pilot study analyzed data from two large-scale surveys (Survey 1: N = 1,859, Survey 2: N = 3,750) to examine the relationship between blood type and personality. AI predicted blood types of participants more than by chance. The ANOVA results of large-scale surveys showed that respondents displayed the personality traits corresponding to their own blood type more strongly than respondents who had different blood types did. This finding was consistent across all traits, and all differences were statistically significant. The same differences in scores were found in the groups who reported no blood type personality knowledge, although the values were smaller. We observed a clear and significant relationship between blood type and personality in large-scale surveys.

Keywords   AI, Blood type, Personality, Large-scale survey

1. Introduction

1.1. Blood Type Personality Theory

Currently, the effect of genetic factors on personality is estimated to be approximately 50% [1-3]. The ABO blood group, discovered by Landsteiner in 1901, is a genetically determined and easily measured biological marker. Hence, much research has been conducted not only on health risks, but also on its impact on personality.

The relationship between blood type and personality is studied at an international scale, and the first academic examination using a statistics base was conducted in 1927 by Furukawa, a Japanese educational psychologist [4-9]. Yet, the epoch that most shapes present-day research is a Japanese book written by Nomi [10], a Japanese independent researcher [4-9].

Nomi adopted the multiple method approach (Table 1) which consisted of a) questionnaires on the tratis of people's behavior and mindset; b) surveys of blood type distribution for various occupations and specialties; c) observations of people's behavior and statistical analyses. The sample sizes of these studies were claimed to be tens of thousands of people. He also suggested that there was a d) association with disease and physical constitution [11].

Table 1.   Blood Type and Its Major Traits of Personality (Nomi)

Blood Type	Personality
O	Purpose oriented. Head straight for a target. Great achievement power. However, do not endure meaninglessness. Give up early if no good. Weigh losses against gains correctly. Hold a belief. Articulate and logical, but somewhat straight. Simple minded in part. Emotions are usually stable and do not linger. Deeply moved. Lose heart when cornered.
A	Cautious about new actions, also pursue stability, but sometimes obsessed and burst into a rage. Desire for molting. Always try to improve. Take a brave action in an emergency. Go step by step after convinced. Formula-like. Prudent judgement, although draw the clear line. Strongly suppressive outside vs violent inside. Recover slowly after got hurt. Concentrate on one at a time.
B	Look for a life with much freedom. Particularly dislike rules or formulas. Do not hesitate to take new actions. Tend to be absorbed in strongly interested things. Multitasking and go overboard. Quick and flexible judgements. Pragmatic and do not draw the line. Emphasize scientific accuracy and validity. Feelings sway, moody. Frankly express anger or sorrow.
AB	Good reflexes, business-like efficiency. Quick and easy understanding. Rationality itself. Good critic and analyst, multi-angle interpretation. Duality with a calm, cool stable side and an easily disturbed side with sentimental fragility. Able to do everything accurately. Good at designing but not cleaning up. Smiling and soft, but keep a certain distance from others.

His questionnaire results showed that the effect size was small to medium, with differences by blood type ranging from 10-20% in absolute response rates. In studies of blood type distributions, Nomi found that Japanese prime ministers were more likely to be O, foreign ministers O and AB, education ministers more likely A or AB; professional baseball hitters of O or B, high-ranking sumo wrestlers A, and so forth; all of which were supported by statistically significant differences. P-values varied widely from below 0.001 to 0.05, dependent upon sample size and other conditions. He also suggested an association with disease and physical constitution [11].

Presently, many Japanese people believe in the relationship between blood type and personality. For example, in a 2015 online questionnaire conducted by Fuji Television Networks, one of the major television networks in Japan, found that 68.7% of a 201,119-person audience believed in the relationship between blood type and personality [12]. These results are in accordance with past observations: a 1986 survey conducted by NHK, the Japanese public broadcaster, found that 75% of 1,102 respondents believe in the relationship [13].

1.2. Results of Previous Studies

Table 2. Blood Type and Its Major Images of Personality (Psychologists)

Blood Type	#	Personality
O	1	I have a lot of friends. I am ready to keep company with everyone. I cannot be quiet and I make merry when I am delighted.
	2	Big-hearted, Laid back, Unassuming
	3	Pleasant, Positive, person of action, Passionate, Show the utmost courage and guts for the target
A	1	I am careful when doing something. I am serious when I should be so. I am often worried about things.
	2	Meticulous, Nervous, Serious
	3	Considerate, careful about everything, Polit, Esteem principle than practice, Responsible, Introvert
B	1	I often change my mind. I am not particular about things. I am not worried by what I was told.
	2	Self-paced, Individual, Lukewarm, Egoistic, Self-centered, Optimistic, Pleasant
	3	Lack of prudence, Self-paced, less influenced by the surroundings, Active and curious; Optimistic
AB	1	I do not change my idea after I present it. I make an effort toward my goal. I sometimes burst into a rage.
	2	Dual personality, Two-faced, Oddball, Hard to understand
	3	Moody and sometimes seen as dual personality, Cool and businesslike, Avoid close human relations

Note. #1: Yamazaki and Sakamoto [14]; #2: Sato, Miyazaki and Watanabe [15]; #3: Watanabe [16].

Japanese psychologists reported the following images of each blood type. Yamazaki and Sakamoto conducted a survey of 177 college students on 24 personality traits in the annual opinion poll by JNN Data Bank, a department of Tokyo Broadcasting Corporation, one of the major television networks in Japan [14]. Sato, Miyazaki and Watanabe surveyed 197 college students and the results of free answers [15]. Watanabe extracted personality traits of each blood type from three or more books and asked 102 college students whether they were applicable [16]. These results are shown in Table 2. Generally, the personality traits studied by Japanese psychologists were consistent with those of Nomi (Table 1).

1.3. Self-fulfilling Prophecy

Self-fulfilling prophecy refers to the phenomenon in which a person who believes in a prophecy learns to act in accordance with the prophecy, thereby bringing the prophecy to being. An example that psychologists have studied is astrology [17-19]. If a person's original personality and his/her sign matches, that tendency becomes stronger. Even if the personality and the sign do not initially match, the personality moves toward what has been indicated. In Japan, South Korea, and Taiwan, roughly half of the people feel the relationship between blood type and personality is legitimate [7,9,20-22]. Logically, the self-fulfilling findings among astrology suggest that one's personality would change in a direction that fits relevant as personality description – of which shown by blood type.

Utilizing those items (Table 2), several large-scale surveys in Japan were designed or re-analyzed by psychologists or other academic researchers after 1990, which clearly confirmed self-reported personality traits using ANOVA. Archetypical sample sizes of these were 6,660 [23], 11,766 [24], 32,347 [14,25] and over 200,000 (our estimation; the exact number was not specified in this report, although it alluded the size was much larger than preceding ones) [26].

Until now, statistical differences had not been confirmed in respondents without blood type personality knowledge. Therefore, the current scientific consensus is that these differences are self-fulfilling phenomena induced by the "contamination by knowledge." However, there was little testing of whether the questions used in these studies were suitable for examining differences among less knowledgeable respondents.

1.4. Contemporary Trends and Issues

After 2000, a growing number of studies proved the previously questioned link between blood type and physical constitution: this demonstration proposed a new approach to medicine [27-28]. For example, more than 10 studies had reported a relationship between susceptibility to COVID-19 and blood type [29-31]. According to these studies, type O was the least susceptible, and type A the most.

There had also been several studies on biological factors, which investigated whether physical constitution affected

personality. A US researcher examined the linkage of disequilibrium between the ABO and DBH genes [32-33]. In 2015, using DNA testing technologies, a genotype of ABO blood type and the personality using the Temperament and Character Inventory (TCI) [34-35] had been determined to be related, as predicted by blood type personality theory [36]. In this study, type A was found to be the most "persistent."

Since blood type is information that is uniquely determined for each individual, predicting blood type is a typical example of "supervised learning" for AI. This is a technique in which the machine learns the personality data (training data) with the blood type as the correct answer. In this study on human personality, therefore, we use both traditional statistical analysis methods and machine learning, which can theoretically handle data of non-linear models.

With the progress of information technology, conducting crowdsourced surveys has become much easier. Nowadays, a larger amount of data can be obtained at a lower cost and in a shorter period. Since machine learning requires a large sample size, this study utilizes a crowdsourced large-scale survey of thousands of people. This makes it possible to analyze not only conventional statistical analysis methods, but also the influence of non-linear models such as self-fulfilling prophecies, gender, and age.

Most Japanese people know their blood type since, until recently, it had been common practice to test the blood type of newborns. This means that analyzing the effect of the phenotype (O, A, B, AB) eliminates physiological type testing, and therefore our survey can be completed via the Internet. Presently, computer performance has improved significantly, and the use of readymade AI, such as the AWS ML (Amazon Web Service Machine Learning), eliminates technical and time-consuming issues, e.g. the construction of training models from scratch.

We make reference to a facial recognition article written by AI engineers aimed at prediction [37], because there is virtually no preceding research available to analyze personality with AI; it is for this reason we utilized AI as an experimental method.

2. Participants and Methods

2.1. Participants

Each participant's blood type of was determined by self-report, because most Japanese people know their blood type as previously stated.

With the intention of avoiding ethical issues, question items on blood type traits of this study were extracted from reviewed academic articles (Table 2). These items were checked again at the previously stated crowdsourcing company which has been passed the Japanese privacy mark (JIS Q 15001). The company confirmed that there was no problem with the question items. It provides customers with anonymized data and obtains informed consent from participants (respondents) prior to its surveys.

Survey 1 was conducted in 2019, and covered 2,000 Japanese people ages 20-59, were asked to rate a total of 12 items representing 4 blood type traits (Table 3), each with scores of 1-5 for their personality traits (the larger the number, the more fitting the trait), asked the respondents to answer which blood type they thought these 12 items would categorize, and scores of 1 to 4 of relationship and their knowledge on the level between blood type and personality (the larger the number, the more related or informed), and marital status. Survey 2 was conducted in 2020, and covered 4,000, twice as many as the previous one, also Japanese people ages 20-59, with blood type traits reduced to 8 items (Table 3). In Survey 2, we changed scores of personality traits from the 5-point scale to the 7-point.

In Survey 1, 141 out of all the 2,000 respondents, or 7.1% of the total, did not know their blood type. Thereby the data of the remaining 1,859 participants with known blood types were used. In Survey 2, which similarly excluded 250 respondents, or 6.3% of the total, and used 3,750 participants. The distributions of blood types were almost equal to the Japanese average measured by the Japan Red Cross Blood Center; O: 29.4%, A: 39.1%, B: 21.5%, AB: 10.0% [38].

We tried to follow those methods of psychological personality testing, and deliberately selected the most suitable traits that would explicitly display the differences: a) images of traits were consistent to the preceding academic studies; b) showed large differences in the academic studies and means were close to 50%; c) did not show extreme values; d) images of traits were consistent to the preceding surveys of other studies.

Table 3. Blood Type and Its Major Traits of Personality (Nomi)

Survey	Blood Type	Personality
Survey 1	O	Positive, Big-hearted, Laid back
	A	Meticulous, Serious, Nervous
	B	Self-paced, Self-centered, Cheerful
	AB	Hard to be understood, Dual personality, Genous-like
Survey 2	O	Big-hearted, Laid back
	A	Meticulous, Nervous
	B	Self-paced, Self-centered
	AB	Hard to be understood, Dual personality

2.2. Analytical Strategy

Firstly, we examine whether AI predict participants' blood type more than chance. Secondly, we focused our analysis on whether personality self-fulfillment was occurring or not: with data from participants who "have no knowledge of blood type traits" or "do not believe in the relationship" (hereinafter abbreviated as "no-knowledge group").

Our analytical methods on personality were as follows:

Analysis 1: Blood type prediction using AI

Analysis 2: ANOVA of blood type and personality of the whole participants

Analysis 3: ANOVA of blood type and personality of the

"no-knowledge" group

All the data of Survey 1 were stored in Amazon S3, and with Amazon Machine Learning, all 12 traits, including gender, age, and marital status, were used as training data for prediction targeting for the blood type, since Nomi claimed that these elements affected personalities. Multinominal logistic regression algorithm was chosen for the prediction. We divided the whole data into five groups of same sample size. Each group was estimated as the prediction data, the rest four groups as the training data, and then the average of the five predictions was calculated. In these cases, since the sample sizes of the AI training data were small (this means that the prediction errors might become larger if we used the raw data of 1-year increment of age), a dummy variable of 10-year increments was used [20s = 2, 30s = 3, 40s = 4, 50s = 5]. The same methods were used as Survey 2.

An analysis of variance (ANOVA) was performed with personality traits scores as the dependent variables and self-reported ABO phenotypes (O, A, B, AB). We set the alpha level to 0.05. Before ANOVA analyses, the normality of distributions was checked for each personality trait score; this showed a normal distribution. The data were analyzed using jamovi software version 1.2.27 [39].

3. Results

3.1. Analysis 1: Blood Type Prediction Using AI

In Survey 1, the accuracy rates were 0.450 (F1 = 0.450) in the group that had good knowledge of blood type traits (542 participants with scores equal to 3 or higher in both item "relation" and item "knowledge"), and 0.401 (F1 = 0.401) in the entire 1,859 participants (Table 4). When gender, age, and marital status were excluded from both the learning and training data, the accuracy rates fell to 0.423 (F1 = 0.423), and 0.396 (F1 = 0.396) respectively. The most common blood type among Japanese is type A, which accounts for 0.372 (692 persons) in this survey. Hence, the accuracy rate became 0.372 if all the participants were assumed to be the type. Amazon Machine Learning predicted the blood type at a higher accuracy than this value in all cases.

Table 4. Survey 1 Result of Blood Type Predictions Using AI

Learning Data	Average Accuracy (5 groups)	
	Well Knowledge (N=542)	All (N=1859)
Blood Type, Gender, Age and Marital Status	0.450 (0.393)	0.401 (0.372)
Blood Type Only	0.423 (0.393)	0.396 (0.372)

Note. Percentages of type A (0.393 and 0.372) are in parentheses.

In Survey 2, the accuracy rates were 0.436 (F1 = 0.436) in the group that had good knowledge of blood type traits (1,067 participants; the same methods were used as Survey 1), and 0.404 (F1 = 0.404) in the entire 3,750 participants (Table 5). When gender, age, and marital status were

excluded from both the learning and training data, the accuracy rates fell to 0.420 (F1 = 0.420), and 0.393 (F1 = 0.393) respectively. As mentioned above, the most common blood type among Japanese is type A, which accounts for 0.369 (1,383 persons) in this survey. Amazon Machine Learning predicted the blood type at a higher accuracy than this value in all cases.

Table 5. Survey 2 Result of Blood Type Predictions Using AI

Learning Data	Average Accuracy (5 groups)	
	Well Knowledge (N=1067)	All (N=3750)
Blood Type, Gender, Age and Marital Status	0.436 (0.376)	0.404 (0.369)
Blood Type Only	0.420 (0.376)	0.393 (0.369)

Note. Percentages of type A (0.376 and 0.369) are in parentheses.

3.2. Analysis 2: ANOVA of Blood Type and Personality of the Whole Participants

In Survey 1, all traits showed the same results as those shown for blood type traits in the preceding psychology studies (Table 2). All traits were statistically significant at $p < 0.05$ (Table 6). All the responses were consistent with the most common images of blood types that respondents expected. All of the responses were consistent with the most common images of blood types that respondents expected, except "cheerful", which was to be type B in academic studies, but type A got the highest score.

Table 6. Survey 1 ANOVA of the Whole Participants

Blood Type Traits	Average Scores by Blood Type				
	O (N=553)	A (N=692)	B (N=434)	AB (N=180)	p
O	**3.30**	3.10	3.12	3.10	**<0.001**
A	3.26	**3.57**	3.33	3.45	**<0.001**
B	3.21	3.13	**3.38**	3.22	**<0.001**
AB	3.05	2.91	3.07	**3.38**	**<0.001**

Note. Highest scores that match with blood type traits, and $p < 0.05$ are highlighted in bold.

Table 7. Survey 2 ANOVA of the Whole Participants

Blood Type Traits	Average Scores by Blood Type				
	O (N=1115)	A (N=1383)	B (N=831)	AB (N=421)	p
O	**4.47**	4.03	4.14	4.05	**<0.001**
A	4.03	**4.53**	4.03	4.21	**<0.001**
B	4.25	4.22	**4.57**	4.30	**<0.001**
AB	3.70	3.76	3.86	**4.33**	**<0.001**

Note. Highest scores that match with blood type traits, and $p < 0.05$ are highlighted in bold.

In Survey 2, all traits showed the same results as those shown for blood type traits in the preceding psychology studies (Table 2). All traits were statistically significant at $p < 0.05$ (Table 7). All the responses were consistent with

the most common images of blood types that respondents expected.

3.3. Analysis 3: ANOVA of Blood Type and Personality of the "No-knowledge" Group

In Survey 1's 621 "no-knowledge" participants, all traits showed the same results as those shown for blood type traits in the preceding psychology studies (Table 2). Two traits of all four were statistically significant at $p < 0.05$ (Table 8).

Table 8.　Survey 1 ANOVA of the "No-knowledge" Group

Blood Type Traits	Average Scores by Blood Type				p
	O (N=168)	A (N=234)	B (N=158)	AB (N=61)	
O	**3.10**	2.92	2.89	2.93	**0.044**
A	3.29	**3.42**	3.24	3.20	0.123
B	3.13	3.09	**3.16**	2.97	0.408
AB	3.01	2.82	2.85	**3.21**	**<0.001**

Note. Highest scores that match with blood type traits, and $p < 0.05$ are highlighted in bold.

In Survey 2's 1,474 "no-knowledge" participants, all traits showed the same results as those shown for blood type traits in the preceding psychology studies (Table 2). All traits were statistically significant at $p < 0.05$ (Table 9).

Table 9.　Survey 2 ANOVA of the "No-knowledge" Group

Blood Type Traits	Average Scores by Blood Type				p
	O (N=419)	A (N=560)	B (N=343)	AB (N=152)	
O	**4.39**	4.04	4.02	4.01	**<0.001**
A	4.11	**4.29**	4.14	4.01	**0.031**
B	4.38	4.27	**4.60**	4.14	**<0.001**
AB	3.80	3.74	3.80	**4.10**	**0.012**

Note. Highest scores that match with blood type traits, and $p < 0.05$ are highlighted in bold.

4. Discussion

Preceding research by psychologists had concluded that there appeared no difference in personality among blood types, and that even if there was a difference predicted by the blood type, it was assumed to be the result of self-fulfillment prophecy phenomena [14,17-19,20, 23,25-26]. However, the same differences in scores were found in the "no-knowledge" groups, although the values were smaller. Therefore, it is highly likely that differences by blood type are real, not caused by self-fulfilling prophecy phenomena; no difference in the "no-knowledge" groups were caused by Type II errors.

In addition, backed on this study's AI result, it was suggested that these phenomena occurred not only because of the wording of question items, but also because gender and age were not taken into account. Our experimental blood type predictions by AI (Amazon Machine Learning) in this study found that adding non-blood type variables, such as gender or age, to the training data considerably increased the accuracy (Tables 4 and 5). Moreover, when performing blood type prediction, AI sometimes failed to build its machine learning models, if gender or age of the training and prediction data were different. In this respect, AI technology may suggest that factors such as gender and age affect the traits of blood type. Therefore, gender, age, and other factors may offer a better explanation, even if past data were inconsistent.

The issue concerning the difference of human personality affected by gender and age, have been explored in the fields of personality psychology and social psychology. Although some people argue that personalities are affected by gender and age, and the differences are non-linear [40-41], others argue that they are not affected [42]. In any case, many researchers seem to agree upon the existence of differences, at least self-reported. We also believe that there are such differences.

Our study has several points to be improved. Firstly, the participants in this study were limited to Japanese populations only. It is necessary to examine whether the same results can be obtained in samples of other countries. Secondly, we used the 2,000- and 4,000-population AI training data, but these are relatively small sample sizes; 10,000 or more persons are desirable. Lastly, researchers have not yet found an appropriate method to utilize AI for personality psychology.

5. Conclusions

AI predicted the blood type of participants more accurately than chance. We found a clear relationship between blood type and the self-reported personality of many question items, which matches traits previously stated. The same traits were observed in the no-knowledge groups, though the difference was smaller. Our findings provide a new, if hypothetical, framework of how genes affect human personality.

Meanwhile, the sample in this study was limited to Japanese populations only, the AI training data was small in sample size, and its use experimental. Additional research using a larger, global dataset is needed in order to address true implications, as well as to improve algorithms and methodologies.

REFERENCES

[1] Ando J, Suzuki A, Yamagata S, Kijima N, Maekawa H, Ono Y, Jang KL. Genetic and environmental structure of Cloninger's temperament and character dimensions. J Pers Disord. 2004; 18(4): 379-393.
DOI: 10.1521/pedi.18.4.379.40345.

[2] Chabris CF, Lee JJ, Cesarini D, Benjamin DJ, Laibson DI. The Fourth Law of Behavior Genetics. Current Directions in Psychological Science. 2015; 24(4) 304–312.
DOI: 10.1177/0963721415580430.

[3] Robert Plomin R, DeFries JC, Knopik VS, Jenae M, Neiderhiser JM. Top 10 replicated findings from behavioral genetics. Perspect Psychol Sci. 2016; 11(1): 3-23.
DOI: 10.1177/1745691615617439.

[4] Furukawa T. A Study of temperament by means of human blood groups. Japanese Journal of Psychology. 1927; 2(4): 612-634. DOI: 10.4992/jjpsy.2.612.

[5] Furukawa T. A study of temperament and blood groups. Journal of Social Psychology 1927; 1: 494–509.
DOI: 10.1080/00224545.1930.9714153.

[6] Rogers M, Glendon AI. Blood type and personality. Pers Individ Dif. 2003; 34: 1099–1112.
DOI: 10.1016/S0191-8869(02)00101-0.

[7] Sato T, Watanabe Y. Psychological studies on blood-typing in Japan. Japanese Psychological Review. 1992; 35: 234–268.
DOI: 10.24602/sjpr.35.2_234.

[8] Wang JQ. Blood type and personality. 2004; Beijing: Beijing Institute of Technology Press.

[9] Wu K, Lindsted KD, Lee JW. Blood type and the five factors of personality in Asia. Pers Individ Dif. 2005; 384: 797-808.
DOI: 10.1016/j.paid.2004.06.004.

[10] Nomi M. Understanding compatibility through blood type. 1971; Tokyo: Seishun Publishing.

[11] Nomi M. New blood type humanics. 1978; Tokyo: Sankei Publishing.

[12] Fuji Television Networks. Nippon no daimondai (November 8, 2015). Tokyo, Japan.

[13] NHK Broadcasting Culture Research Institute. A survey on "scientific technology and live". Tokyo: NHK Service Center (NHK Broadcasting Culture Research Institute, 1986).

[14] Yamazaki K, Sakamoto A. Self-fulfillment phenomenon generated by blood-typical personality stereotypes: time-series analysis of nation-wide survey. 32nd Annual conference of Japanese society of social psychology. 1991; 32: 289-292.

[15] Sato T, Miyazaki S, Watanabe Y. An examination of the blood type personality relationship theory (3) from stereotype to prejudice. 2nd convention of Japan Society of Development Psychology. 1991; 147.

[16] Watanabe Y. The roles of prototype and exemplar in the formation of the "blood type stereotype". Japanese Statistical study on personality differences by blood type. Japanese Journal of Social Psychology. 1994; 10(2): 77-86.
DOI: 10.14966/jssp.KJ00003724631.

[17] Eysenck HJ, Nias DKB. Astrology: Science or superstition?. 1982; London: Curtis Brown Temple Smith.

[18] Glick P, Snyder M. Self-Fulfilling Prophecy: The psychology of belief in astrology. Humanist. 1986; 46(3): 20-24.

[19] Snyder M. When Belief Creates Reality. Advances in Experimental Social Psychology. 1984; 18, 247-305. DOI: 10.1016/S0065-2601(08)60146-X.

[20] Cho SH, Suh EKM, Ro YJ. Beliefs about blood types and traits and their reflections in self-reported personality. Korean Journal of Social and Personality Psychology. 2005; 19(4): 33-47. Retrieved from http://kiss.kstudy.com/thesis/thesis-view.asp?key=2498184.

[21] Kamise Y, Matsui Y. Functions and structure of blood-group stereotype. Bulletin of University of the Sacred Heart. 1994; 82: 90-111.

[22] Ryu SI, Sohn YW. A Review of Sociocultural, Behavioral, Biochemical Analyzes on ABO Blood-Groups Typology. Korean Journal of Social and Personality Psychology. 2007; 21(3): 27-55. DOI: 10.21193/kjspp.2007.21.3.003.

[23] Yamaoka S. Discrimination and delusion of blood type personality divination. 18th Annual Meeting of Japan Society of Personality Psychology. 2009; 18, 11.
DOI: 10.24534/amjspp.18.0_11.

[24] Matsui Y. A statistical analysis of personality difference by blood type. Bulletin of Tokyo Metropolitan Tachikawa Junior College. 1991; 24: 51-54.

[25] Sakamoto A, Yamazaki K. Blood-typical personality stereotypes and self-fulfilling prophecy: A natural experiment with time-series data of 1978-1988. Progress in Asian Social Psychology. 2004; 4: 239-262. Seoul: Kyoyook-KwahakSa.

[26] Muto C, Nagashima M, Harada J, Abe S, Furuya Y, Kamizon K, Konishi Y. A demonstrative and critical study on pseudo-science for scientific literacy construction at teacher education course. Grants-in-Aid for Scientific Research FY2011 Final Research Report (Japan). 2012. Retrieved from https://kaken.nii.ac.jp/en/grant/KAKENHI-PROJECT-22650191/.

[27] Ewald DR, Sumner SC. Blood type biochemistry and human disease. Wiley Interdiscip Rev Syst Biol Med. 2016; 8(6): 517-535. DOI: 10.1002/wsbm.1355.

[28] Risch NJ. Searching for genetic determinants in the new millennium. Nature. 2000; 405(6788): 847-56.
DOI: 10.1038/35015718.

[29] Barnkob MB, Pottegård A, Støvring H, Haunstrup TM, Homburg K, Larsen R, Hansen MB, Titlestad K. Reduced prevalence of SARS-CoV-2 infection in ABO blood group O. Blood Adv. 2020; 4(20): 4990-4993.
DOI: 10.1182/bloodadvances.2020002657.

[30] Hoiland RL, Fergusson NA, Mitra AR, Griesdale DEG, Devine DV, Stukas S et al. The association of ABO blood group with indices of disease severity and multiorgan dysfunction in COVID-19. Blood Adv. 2020; 4(20): 4981–4989. DOI: 10.1182/bloodadvances.2020002623.

[31] Severe Covid-19 GWAS Group. Genomewide association study of severe Covid-19 with respiratory failure. N Engl J Med. 2020; 383(16): 1522-1534.
DOI: 10.1056/NEJMoa2020283.

[32] Hobgood DK. Personality traits of aggression-submissiveness and perfectionism associate with ABO blood groups through catecholamine activities. Med Hypotheses. 2011; 77: 294–300. DOI: 10.1016/j.mehy.2011.04.039.

[33] Hobgood DK. ABO B gene is associated with introversion personality tendancies through linkage with dopamine beta hydroxylase gene, Medical Hypotheses. 2021; 148(3). 110513 DOI: 10.1016/j.mehy.2021.110513.

[34] Cloninger CR. A systematic method for clinical description and classification of personality variants. A proposal. Archives of General Psychiatry. 1987; 44: 573-588. DOI: 10.1001/archpsyc.1987.01800180093014.

[35] Kijima N, Saito R, Takeuchi M, Yoshino I, Ono Y, Kato M, Kitamura T. Cloninger's seven-factor model of temperament and character and Japanese version of Temperament and Character Inventory (TCI). Kikan Seishinka Shindangaku. 1996; 7: 379-399. Retrieved from https://www.institute-of-m ental-health.jp/thesis/pdf/thesis-06/thesis-06-04.pdf.

[36] Tsuchimine S, Saruwatari J, Kaneda A, Yasui-Furukori N. ABO blood type and personality traits in healthy Japanese subjects. PLoS ONE. 2015; 10(5): e0126983. DOI: 10.1371/journal.pone.0126983.

[37] Nakamura H, Iwasada S. Cloud is good for studying image deep learning! A challenge to make up a Raspberry Pi AI to guess blood type from face photo. Interface 2017; 43(4): 125-133. Tokyo: CQ Publishing.

[38] Okubo Y. Pretransfusion Testing with Special Reference to Blood Groups in Japanese (2nd ed.). 1997; Tokyo: Ishiyaku Publishers.

[39] The jamovi project. https://www.jamovi.org/.

[40] Soto CJ, John OP, Gosling SJ, Potter J. Age differences in personality traits from 10 to 65: Big Five domains and facets in a large cross-sectional sample. Journal of Personality and Social Psychology. 2011; 100(2): 330-48. DOI: 10.1037/a0021717.

[41] Kawamoto T, Oshio A, Abe S, Tsubota Y, Hirashima T, Ito H, Tani I. Age and Gender Differences of Big Five Personality Traits in a Cross-Sectional Japanese Sample. Japanese Journal of Developmental Psychology 2015; 26(2): 107-122. DOI: 10.11201/jjdp.26.107.

[42] Costa PT, Terracciano A, McCrae RR. Gender differences in personality traits across cultures: robust and surprising findings. Pers Soc Psychol. 2001; 81(2): 322-331. DOI: 10.1037/0022-3514.81.2.322.