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Effects of Turmeric paste on Growth Performance, Immune response and Blood characteristics in Japanese Quail

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Abstract:

The experiment was conducted from February-March 2018 at the poultry research shed under the Department of Physiology and Pharmacology, Hajee Mohammad Danesh Science and Technology University, Dinajpur. The present study was investigated to know the effects of turmeric paste on growth performance, immune response and Blood characteristics in Japanese quail. In this study, forty 14-days old quail were assigned to four dietary treatments named T0, T1, T2 & T3 with Ten (10) birds in each groups in completely randomized design. Turmeric paste was supplemented to T0, T1, T2 & T3 through feed at the rates of 0%, 0.5%, 1.5% and 2.5% respectively throughout the rearing period from 14-day old to 49-day old. Body weight gain, feed consumption and feed conversion ratio were measured on a weekly basis. Blood samples were collected at the 35th and 49th day of age for determination of Blood characteristics (PCV, Hb and ESR) and antibody titers against infectious coryza. At the end of the experiment, 3 birds per group were slaughtered to obtain carcass characteristics data. The results of this study was indicated that final live weight gain and feed conversion ratio of birds was significantly ($p<0.05$) higher that received 2.5% turmeric paste compared to control T0. This result also indicated that body weight gain, feed consumption and feed conversion ratio was increased along with increasing dose of Turmeric paste. Carcass characteristics were no significant difference among the treatment group except breast meat weight. Blood parameters (PCV and Hb) there were significant ($p<0.05$) difference among the treatment groups. Turmeric supplementation improved antibody titers against infectious coryza. It can be concluded that turmeric has the potential to improve growth performance, immune response and blood characteristics and its use at 2.5% through feed is commended for better results.

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INTRODUCTION

Poultry is one of the best growing segments of the agricultural sector in Bangladesh. It plays a vital role in the subsistence economy and contributes 1.6% in GDP (SAEDF 2008) in Bangladesh. Bangladesh Government initiated activities with the aim of improving the livelihoods of the poor sections by involving them in livestock and poultry rearing. The smallholder livestock development programme involving this group of people began in Bangladesh in 1984-85. To this end, the World Food Programme (WFP) played a vital role by providing assistance in the form of food aid, training and other logistical support. Still the Government is trying to protect the poultry sector from any hazards and is also promoting this sector through the motivation of village people and youth, training of rural women and landless farmers, small credit and input supply etc. With the aim of poverty reduction. Bangladesh is a highly populated country and growth of population is increasing very fast in comparison to its land size, as a result huge pressure is created on people's basic needs. Demand of protein of this booming population is a great threat for us. There are so many sources of protein but it is impossible to fulfill the demand without Poultry meat and egg. Different types of poultry are present. Quail is one of them. Quail meat is popular to all of us and there is no religious restriction to consume. Quail meat is very tasty and nutritious. Fat is very low in their meat. So quail meat is very suitable for blood pressure patients. Eggs are very beautiful with multiple color. In our country, commercial farming of these birds is increasing day by day as the investment and maintenance is very low when compared to other birds. Phytogenic growth promoters are ideal for poultry because they are natural, residue free, eco-friendly and having no side effects. They enhanced feed consumption, improved digestion and growth performance, minimized the incidence of disease and increased profitability. Due to its medicinal properties, the use of Turmeric (Curcuma longa) in poultry feed became extensive during the last decade. Curcumin is the main important bioactive ingredient responsible for the biological activity of curcuma (Nouzarian *et al.* 2011). Curcumin has been shown to have several biological effects, exhibiting anti-inflammatory (Holt et al., 2005), antioxidant (Iqbal et al. 2003; Pal et al., 2001) and hypolipidaemic (Ramirez Tortosa *et al.,* 1999) activities.

In view of the above facts, this study is to observe the Effects of Turmeric Paste on Growth Performance, Immuno Response and Blood Characteristics in Japanese Quail with the following specific objectives:

To see the effect of turmeric supplementation on feed consumption, feed conversion ratio, live body weight, body weight gain and carcass characteristics in quail.

To determine the effect of turmeric supplementation on antibody production against infectious coryza and blood characteristics in quail.

MATERIALS AND METHODS

2.1 Statement of the experiment

The experiment was conducted for a period of 5 weeks from 4st February to 10th March, 2018 at poultry research shed under the Department of Physiology and Pharmacology, Hajee Mohammad Danesh Science and Technology University (HSTU)

2.2 Management of experimental shed

At first the shed for rearing quail was properly prepared. The experimental pens were thoroughly cleaned, white washed and disinfected before putting the experimental chick into these.

2.3 Collection and management of quails

At 14 days of age, Japanese layer quails were collected from H. R. Enterprise (live bird and feed seller), Dinajpur.. The finally selected 40 quails were housed under normal husbandry condition and reared quail in quail cage All the groups were reared under the similar conditions of temperature, humidity, light, ventilation and floor space. The body weights of assigned quails were taken with digital weight balance and the data were recorded.. All of them were fed with commercial crumbled plus mesh feed at the rate of 30 g per bird per day and fresh water *ad-libitum.* During the whole experimental period, all quail were exposed to a 16 hours continuous photoperiod (natural light + artificial light) in an open sided house.

2.4 Experimental design

The total number of 40 quails were randomly selected and divided into 4 groups (T_0, T_1, T_2, T_3) at completely randomized design. Quails of group T_0, 10 quails were kept and are considered as control, fed only with commercial quail ration. Quails of group T_1, 10 quails were supplemented with formulation of .5g turmeric paste per kg feed. Quails of group T_2, 10 quails were supplemented with formulation1.5g turmeric paste per kg feed. Quails of group T_3, 10 quails were supplemented with formulation of 2.5g turmeric paste per kg feed.

2.5 Collection of experimental materials and feed

Fresh turmeric was collected from local market in Dinajpur. Loose feed were used for ration formulation for feeding experimental quail and it was purchased from the local market of Dinajpur. The ration was formulated to meet all nutrient requirements as specified by the 9th revised edition of National Research Council (NRC, 1994) for layer and was designated as the control diet.

2.6 Observation of growth performance

2.6.1 Feed consumption

Feed consumption is the amount of feed consumed every week; it was calculated for each treatment at weekly basis. The product was divided by the total number of birds.

2.6.2 Live body weight gain

The body weight of each quail measured with the help of digital balance
Body weight gain = Final body weight - initial body weight

2.6.3 Feed conversion ratio

During the 35 days experimental period, body weight gain and feed consumption were recorded weekly and feed conversion ratio was then calculated.

2.6.4 Carcass characteristics

At the end of the experiment 3 birds from each group were randomly selected and slaughtered to obtain data on carcass characteristics

2.7 Vaccination of quail

Experimental birds were vaccinated against infectious coryza by NOBILIS CORVAC vaccine. Vaccination was done by eye-drop method at Day 22 and quail were re-vaccinated through drinking water at Day 35.

2.8 Measurement of antibody titer against infectious coryza

Blood samples (3 birds/group) were collected at Day 28 and 49 for determination of antibody titers against infectious coryza. These samples were collected from the brachial vein in 5 ml sterilized syringes and pooled from each group and 12 blood samples were analyzed. After collecting blood the syringes were kept in slanted position to obtain serum. The serum was transferred into sterilized 0.5 ml serum cups.Determination of antibody titers against infectious coryza was done by using Thermo Scientific™, Easy-Titer™ Mouse IgG Assay Kit, Catalog number: 23300 by Thermo Fisher Scientific.

2.9 Blood characteristics

Blood samples were collected from wing vein of quail of both control and treated groups at 35t h and 49th day to observe the following characteristics:

(a) Total Erythrocyte Count (TEC)
(b) Hemoglobin estimation (Hb)
(c) Erythrocyte Sedimentation Rate (ESR)

2.9.1 Determination of total erythrocyte count (TEC)

Total erythrocyte count was done following the method described by Lamberg and Rothstein (1977). Well-mixed blood sample was drawn with red blood cell diluting pipette exactly up to 0.5 marks of the pipette. Outside of the tip of the pipette was wiped with cotton. Then the pipette was immediately filled with the red cell diluting fluid (Hayem's solution) up to 101 marks. The free end of the pipette was wrapped around with the rubber tube stretching to both the ends and held with thumb and middle finger. The content of the pipette was mixed thoroughly by shaking with 8-knot motion for 3-5 minutes. Then the counting chamber was placed with special cover glass under microscope using low power (10×) objectives. After discarding 2 or 3 drops of fluid from the pipette, a small drop was placed to the edge of the cover glass on the counting chamber as the entire area under the cover glass was filled by the fluid. One-minute time was spared to allow the cells to settle on the chamber under the cover glass. Taking 5 larger squares (4 in the 4 corners and the central one) of the central large square, the cells were counted from all the 80 small squares (16 × 5) under high power objectives (45×). After completion of counting, 21 the total number of RBC was calculated as number of cells counted × 10,000 and the result was expressed in million/µl of blood.

2.9.2 Determination of haemoglobin concentrations (Hb)

The N/10 hydrochloric acid (HCL) was taken in a graduated tube up to 2 marks with the help of a dropper. Well-homogenized blood sample was then drawn into the Sahli pipette up to 20 cm. mark. The tip of the pipette was wiped with sterile cotton and the blood of the pipette was immediately transferred into the graduated tube containing hydrochloric acid. This blood and acid were thoroughly mixed by stirring with a glass timer. There was a formation of acid hematin mixture in the tube by hemolysing red blood cells by the action of HCL. The tube containing acid hematin mixture was kept standing in the comparator for 5 minutes. After that distilled water was added drop by drop. The solution was mixed well with a glass stirrer

until the color of the mixture resembled to the standard color of the comparator. The result was read in daylight by observing the height of the liquid in the tube considering the lower meniscus of the liquid column. The result was then expressed in g%. The above procedure was matched by the Helligehemometer method as described by Lamberg and Rothstein (1977).

2.9.3 Determination of erythrocyte sedimentation rate (ESR)

The fresh anticoagulant blood was taken into the Wintrobe haematocrit tube by using special loading pipette exactly up to 0 marks. Excess blood above the mark was wiped away by sterile cotton. The filled tube was placed vertically undisturbed on the wooden rack for one hour. After one 22 hour the ESR was recorded from the top of the pipette. The result was expressed in mm/in 1st hour.

2.7 Statistical Analysis

The data were analyzed by analysis of variance using complete randomized design with factorial arrangement of time and treatments (Steel and Torrie, 1986). All analyses were performed by SPSS Program Version 22.

RESULTS AND DISCUSSION

In this experiment, all the treatments supplied with various levels of turmeric paste in growth performance, immune response and blood characteristics which are discussed below-

3.1 Effect of turmeric paste supplementation on feed consumption of quail

Feed intake(Table 1) of quail in different dietary treatments during experimental periods was almost statistically similar and the differences were non-significant (P>0.05). The results closely related with the report of Chowdhury *et al.* (2002) and Reddy *et al.* (1991), showed feed consumption, feed efficiency and egg production were not affected by supplements of 2.5 4, 6, 8 or 10% turmeric paste. Lim *et al.* (2006) and Yalcin *et al.* (2006), who found no significant changes in layer feed intake when layer diets were supplemented with TP. Similarly, Ologhobo *et al.* (2008) reported no significant effect of dietary sun-dried TP on feed intake.

3.2 Effect of turmeric paste supplementation on body weight gain of quail

The efficacy of supplementation of turmeric paste @ 0.5%, 1.5% and 2.5% upto 7 weeks increase live weight weekly basis compared to the control T_0 group. Within the turmeric group respective treatment .5%, 1.5% & 2.5 in feed live weight was found (127.7±16g), (132.5±16 g) and (138.6±11.8 g). Live weight of 6^{th} and 7^{th} weeks there were a significant ($p<0.05$) differences among the treatment group. Supplementation of turmeric paste 2.5% was showed the maximum live weight gain and statistically significant ($p<0.05$) compare to plain feed group. The significant effect of turmeric on body weight gain was in agreement with the findings of some previous studies Singh *et al.* (2017) who reported that supplementation of turmeric at different inclusion level (0.6%, 0.9% and 1.2%) result of this study (up to 6 weeks) indicated that growth performance increase significantly that receive (0.6%, 0.9% and 1.2%) turmeric compared to the control group in broiler. Islam *et al.* (2017)

who showed that the live weight gain and feed efficiency were significantly (P<0.05) better in the broilers provided 1.5% turmeric compare to control.

3.3 Effect of turmeric paste supplementation on feed conversion ratio of quail

Feed conversion ratio in different dietary treatment at .5, 1.5 and 2.5 percent level had no significant effect (P>0.05) on feed efficiency. The results indicate that there was no effect on feed efficiency after feeding up to 2.5 percent level of turmeric paste. This is in agreement with the result of Chowdhury *et al.* (2002) and Reddy *et al.* (1991) reported that feed efficiency was not affected by supplements of 0, 2, 4, 6, 8 or 10% turmeric paste (P > 0.05) as averaged over the 6-week period or by supplements of 0.02% turmeric paste over eight weeks. In contrast, Canogullari *et al.* (2010) supplementation of diets with turmeric paste had significant (P < 0.05) effects on feed consumption, feed efficiency.

3.4 Effect of turmeric paste supplementation on carcass characteristics of quail

Dressing Percentage

Dressing percentage of different treatment group showed in (Table 4). The Table indicated that, there were no significant differences among the treatment group. Relatively the heavier dressing percentage was observed in T_3 (63.19%) than other treatments T_0 (61.25%), T_1 (61.89%) and T_2 (62.55%) respectively. This finding favorably compared with earlier reports Darabighane *et al.* (2011) who found that the groups treated by turmeric paste has heavier dressing percentage compared to the control group. In same viewed Singh *et al.* (2013) reported that turmeric paste the group that was given turmeric paste showed numerically higher dressing percentage as compared to control group and drug control group.

3.4.1 Effect on breast meat

Breast meat obtained (Table 4) was statistically significant (P<0.05) among the different treatment group. Supplementation of 2.5% turmeric paste was significant (P<0.05) compare to control group and T_2 treatment group. This result near with Fallah (2015) who found that highest thighs, breast and total carcass weights were observed with supplementation 2.5% turmeric paste than other groups.

3.4.2 Effect on thigh meat

Data obtained from (Table 4) Thigh meat of quail was statistically non significant (p>0.05) among the different treatment group. Best result was observed in supplementation of turmeric paste treated group T_3 (9.5g) where as nutritional commercial group T_0 (8.0g) then T_1 (8.5g) and T_0 (9.1g) respectively.

3.4.3 Effect on heart, liver and gizzard weight

Heart, gizzard and liver weight of quail in different dietary treatment groups was statistically insignificant (p>0.05). From (Table 4) it was seen that head weight maximum in T_3 treatment group and minimum in T_0 treatment group. Heart and liver weight was similar while gizzard weight was maximum (2.0±1g) found in T_3 treatment group.

3.5 Effect of turmeric paste supplementation on immune response (antibody titer against infectious coryza) of quail

Turmeric paste at the rate of 2.5% showed the highest antibody titers against Infectious coryza. The results of the present study regarding the immune response coincide with the

findings of Qasem *et al.* confirming that TP supplementation at the rates from 1.0 up to 3.0% significantly improved antibody titer against Infectious Coryza, while the titer against Infectious Coryza was significantly higher when TP was added in the feed at the rates of 1.4 and 1.6%. However, Nouzarian *et al.,* observed no significant effect of turmeric on the titer against Infectious Coryza when it was supplemented at the rates of 0.33, 0.66 and 1.0%. Qasem *et al.,* also did not find positive results of turmeric on Infectious Coryza titer when it was supplemented at the rates of 1.0, 1.2,1.8and2.0%.

3.6 Effect of turmeric paste supplementation on blood characteristics of quail

Supplementation of turmeric paste, the results of the blood analysis of the experimental birds are present in (Table 6). It was observed that there were no significant ($p<0.05$) differences among the treatment groups in all the blood characteristics except the Hb and PCV. Hb value with birds on treatments T_2 and T_3 this was significantly ($p<0.05$) higher than the Hb value of birds on treatment T_0 and T_1 due to phytogenic effect of turmeric paste. Hb values of birds on treatments T_2 and T_3 were statistically similar ($p>0.05$). The Hb values of treatment T_0 and T_2 did not differ significantly ($p>0.05$). However, the highest values of Hb found in supplementation of 2.5 turmeric paste feed and lowest values were found in control group. Treatment T_2 and T_3 have significant ($p<0.05$) difference compared to control group T_0 while insignificant ($p>0.05$) to T_1 nutritional commercial group. In case of PCV, the highest values of PCV found in supplementation of .5% and 2.5% turmeric paste feed and lowest values was found in T_2 group. Treatment T_2 and T_3 have significant ($p<0.05$) difference compared to control group T_0 while insignificant ($p>0.05$) to T_1 nutritional commercial group. In case of ESR, the highest values of ESR found in supplementation of 0% turmeric paste feed and lowest values was found in T_3 group. Treatment T_2 and T_3 have significant ($p<0.05$) difference compared to control group T_0 while insignificant ($p>0.05$) to T_1 nutritional commercial group.In neutrophil percentage the highest value (57%) was found in turmeric paste group that receive 2.5 turmeric paste on feed and lowest value was found (54%) in T_0 control group. Lymphocyte percentage nutritional commercial group T_0 showed lowest result (39%) and highest result found (41%) in T_2 group. In monocyte, Eosinophil and basophil percentage the result in all treatment was statistically similar. The similar result obtained from Singh *et al.* (2013) who was reported that Hb, PCV, TLC, total plasma, glucose and serum calcium values was higher in turmeric paste treated group that receive 2.0% turmeric paste compared to control group in broiler. Mmereole (2008) reported that increase TEC, PCV, TLC, MCH, MCV, MCHC values in turmeric paste treated group that receive (1% turmeric paste) as compared to antibiotic supplemented group in broiler. Turmeric paste on feed significantly increases blood parameters (RBC, WBC, PCV & ESR) in broiler Olupona *et al.* (2010). Blood analysis result of quail was near to normal blood reference values of *Gallus Gallus* domesticus (Jain 1993). This results disagree with (Valle paraso *et al.* 2006) who was found that *turmeric paste* at 2% feed in broiler there was a significantly ($P<0.05$) increase in total WBC count along with absolute differential count of monocytes, lymphocytes and heterophils.

CONCLUSION

The present study indicates that Turmeric paste may be used as a growth promoter for Japanese quail up to 2.5% level.The highest body weight was obtained in T_3 followed by T_0 which differ significantly ($P<0.01$) from each other. Feed consumption of quail in different dietary treatments (461.56g, 473.37g, 509.04g and 533.09g respectively) were non-significant ($P>0.05$). Feed conservation ratio (FCR) was highest in T_2 (4.82) compared with

other group. Adding Turmeric paste at the rate of 2.5% showed the highest antibody titers (117.33) against Infectious coryza than other group(62.66, 112.00 and 108.33 respectively). Supplementation of turmeric paste at the rates of 1.5 and 2.5% significantly improved dressing percentage. The supplementation did not significantly affect the organs weight. Haematological characteristics of quail (PCV and Hb) there were significant ($p<0.05$) difference among the treatment groups. To establish the Turmeric as a growth promoter, it is necessary to do more research

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Table 1: Effect of turmeric paste on feed consumption of quail from 14 to 49 days of age.

Days	Control	Treatment Groups			P Value	Level of significance
	T_0	T_1	T_2	T_3		
21 days	85.0 ±0.56	86.0± 0.76	92.01± 0.32	98.50± 0.12	0.992	NS
28 days	90.05 ± 1.53	91.02 ± 1.22	98.02± 1.9	100.03 ± 1.12	0.629	NS
35 days	92.01 ± 1.45	93.05 ±1.38	99.00 ±1.64	108.0± 1.71	0.538	NS
42 days	95.5± 1.35	98.20 ±1.15	109.01±1.54	110.0± 1.51	0.739	NS
49 days	99.00± 0.2	105.110 ± 0.07	111.00 ± 0.04	117.40 ± 0.09	0.548	NS
Total	461.56	473.37	509.04	533.93	0.579	NS

The mean values with different superscript (a to c) within the same row differs significantly, at least ($p<0.05$). **** = Significant at 1% level of significance ($P<0.01$) * means significant at 5% level of significance ($P<0.05$) NS = Not significance ($P>0.05$)

Table 2: Effect of turmeric paste on live body weight of experimental quails at 7 days interval

Days	T_0	T_1	T_2	T_3	P-value	Level of significance
Day 14 Mean ± SD (gm)	23.81 ±0.68	25.24± 0.68	26.67± 0.24	25.48± 0.87	0.992	NS
Day 21 Mean ± SD (gm)	42.1 ± 1.03	43.5± 0.58	45.5 ± 0.75	48.6 ± 0.49	0.536	NS
Day 28 Mean ± SD (gm)	65.3 ± 1.44	67.9± 1.21	72.80 ± 1.46	75.7 ± 1.28	0.521	NS
Day 35 Mean ± SD (gm)	87.3 ± 1.39	90.5 ± 0.86	92.13 ± 1.28	98.54± 1.14	0.738	NS
Day 42 mean ± SD (gm)	114.32^{a} ±1.43	119.57^{b} ± 1.16	118.05^{ab}± 1.46	121.82^{c} ± 1.00	0.000	**
Day 49 mean ± SD (gm)	125.7^{a} ± 1.43	127.7^{b} ± 1.16	132.5^{c}± 1.46	138.6^{c} ± 1.00	0.001	**
Weight gain (g)	101.89^{a} ± 1.45	102.46^{a} ±1.38	105.83^{b} ±1.64	113.12^{c}± 1.71	.001	**

Table 3: Effect of turmeric paste on average feed conversion ratio of quail from 14 to 49 days of age.

Variables	Control	Treatment Groups			P Value	Level of significance
	T_0	T_1	T_2	T_3		
Feed conversion ratio (FCR)	4.53± 0.2	4.62 ± 0.07	4.81 ± 0.04	4.72 ± 0.09	.801	NS

Table 4: Effects of turmeric paste on carcass characteristics of quail

Parameters	T_0 **control**	T_1 (0.5% turmeric paste)	T_2 (1.5% turmeric paste)	T_3 (2.5% turmeric paste)	P Value	**Level of Sign.**
Final Live wt. (g)	125.7^{a} ± 1.53	127.7^{b} ± 1.22	132.5^{b}± 1.9	138.6^{c} ± 1.12	0.001	*
Dressing (%)	61.25±0.35	61.89±0.24	62.55±0.2	63.19±0.31	0.992	NS
Breast meat wt. (g)	23.9^{a} ±4.3	26.5^{b} ±6	28.4^{c} ±5.5	29.7^{c} ±3.8	0.000	*
Thigh meat wt.(g)	8±2	8.19±2	9.0±2	9.5±1.5	0.653	NS
Heart (g)	1.01+05	1.1+.25	1.05+.3	1.2+.32	0.572	NS
Liver (gm)	2.77±1	2.52±1	2.37±2	3.15±1.5	0.531	NS
Gizzard (gm)	1.5±1	1.7±1	1.9±1	2.0±1	0.698	NS

Table 5: Effect of turmeric paste on Immune response (antibody titer) of experimental quail

Parameters	T_0 Control	T_1 (.5% turmeric paste)	T_1 (.5% turmeric paste)	T_1 (.5% turmeric paste)	P Value	Level of sign.
Infectious coryza (antibody titer) 35 days	45	87	79	1.3	0.992	NS
Infectious coryza (antibody titer) 49 days	62.66^{a}	112.00^{ab}	108.33^{b}	117.33^{c}	0.001	*

Table 6: Effect of turmeric paste on blood characteristics of quail

Parameters	T_0 Control		T_1 (0.5% turmeric paste)		T_2 (1.5% turmeric paste)		T_3 (2.5% turmeric paste)		P Value	Level of sign.
PCV %	27	32	26	35	28	30	27.5	35	0.001	*
TEC (Million/mm^3)	1.7	1.9	1.96	2.1	2.0	2.11	2.1	2.2	0.992	NS
Neutrophil %	49	54	51	55	52	56	52.9	57	0.628	NS
Lymphocyte %	33	41	37	39	38.12	39	39	40	0.653	NS
Eosinophil %	0.85	1	0.84	1	0.85	1	0.84	1	0.572	NS
Monocyte %	0.92	1	0.93	1	0.92	1	0.92	1	0.531	NS
Basophil %	0	0	0	0	0	0	0	0	0.698	NS
Hb (g/dl)	6.9	7.5	7.9	8.2	8.3	9	10.2	11	0.00	*
ESR(mm/hr)	22	28	26	30	23	25	17	21	0.679	NS

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